Booklet

Units of measurement

A compilation by

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Contents

Units of measurements:

Any division of quantity accepted as a standard of measurement or exchange.

Terminology

CGS System: System of measurement based on centimetres, grams, and seconds or widely known a metric system

Metric unit: A decimal unit of measurement of the metric system (based on meters and kilograms and seconds)

Foot Pound System: Of or relating to a measurement system that uses the foot as a measure of distance, the pound as a measure of force, and the second as a measure of time

British Imperial System or British system: A system of weights and measures based on the foot and pound and second and pint

Note-

1. For units in FPS system there is a variation in UK and US measurements. Therefore, the word US is mentioned against the units specifically used in United States.
2. For detailed descriptions, definition, abbreviations, and, units of measurement refer **Dictionary of units of measurement**

Apothecaries Weight	Any weight unit used in pharmacy; an ounce is equal to 480 grains and a pound is equal to 12 ounces
Astronomical units	A unit of length used for distances within the solar system; equal to the mean distance between the Earth and the Sun (approximately 93 million miles or 150 million kilometres)
Atmospheres	A unit of pressure: the pressure that will support a column of mercury 760 mm high at sea level and 0 degrees centigrade
Aught	A unit used by jewellers and craftspeople to measure the size of small beads (often-called seed beads). The measurement scale is inverted: Larger numbers of aught correspond to smaller beads. Beads of size 11/0, a common size, average a little less than 2 millimetres in diameter, and other sizes are more-or-less inversely proportional. The measure may have originated as the number of beads that could comfortably be strung on one inch of cord; with present sizes, a string of n beads of size n/0 occupies about 0.8 inch (20 mm).
Avoirdupois	The name of the system comes from the Old French phrase avoir du pois or aveir de pois, “goods of weight”, indicating simply that the goods were being sold by weight rather than by volume or by the piece. A system of weights based on the 16-ounce pound (or 7,000 grains)
Bars	(meteorology) a unit of pressure equal to a million dynes per square centimetre

British thermal units	A unit of heat equal to the amount of heat required to raise one pound of water one degree Fahrenheit at one atmosphere pressure; equivalent to 251.997 calories
Bucket	4 imperial gallons or 18.182 litres
Calories	Unit of heat defined as the quantity of heat required to raise the temperature of 1 gram of water by 1 degree centigrade at atmospheric pressure
Calories	A unit of heat equal to the amount of heat required to raise the temperature of one kilogram of water by one degree at one atmosphere pressure; used by nutritionists to characterize the energy-producing potential in food
Capacity	The amount that can be contained
Cargo	Goods carried by a large vehicle
Cental	A United States unit of weight equivalent to 100 pounds
coulomb	A unit of electrical charge equal to the amount of charge transferred by a current of 1 ampere in 1 second
Denier	A unit of measurement for the fineness of silk or nylon or rayon
Density	The amount per unit size
Density, line	Line density is a measure of mass per unit length
Donkey power	A somewhat light-hearted metric unit of power equal to 250 watts or about 0.3353 horsepower
Dynes	A unit of force equal to the force that imparts an acceleration of 1 cm/sec/sec to a mass of 1 gram
ems	A linear unit (1/6 inch) used in printing
Energy	a thermodynamic quantity equivalent to the capacity of a physical system to do work; the units of energy are joules or ergs (physics)
Gray	The SI unit of energy absorbed from ionizing radiation; equal to the absorption of one joule of radiation energy by one kilogram of matter; one grey equals 100 rad
Groat	A former English silver coin worth four pennies
Guinea	A former British gold coin worth 21 shilling
henry	A unit of inductance in which an induced electromotive force of one volt is produced when the current is varied at the rate of one ampere per second
Horsepower	A unit of power equal to 746 watts
Illuminance	The luminous flux incident on a unit area
International nautical mile	The nautical mile as currently defined by international agreement, equal to exactly 1852 metres or 6076.11549 feet. This long name is sometimes used to distinguish the current nautical mile from older units; historically based on the distance spanned by one minute of arc in latitude

Karat (carat)	a traditional unit of mass for precious stones, now spelled carat; a traditional measure of proportion equal to 1/24, used by jewellers to express the purity of gold alloys
Knot	A unit of velocity equal to one nautical mile per hour. Knots are customarily used to express speeds at sea, including the speed of the ship as well as the speeds of the wind and of the current. The word comes from the former method of measuring a ship's speed, which involved use of a knotted cord called the log line. One knot equals about 1.1508 miles per hour, exactly 1.852 kilometres per hour, or 0.5143 metres per second.
Kos	(in India) a unit of length having different values in different localities
lambda	A metric unit of volume equal to the cubic millimetre (mm^3) or micro-litre (μL). The lambda has been used in chemistry in measuring very small samples. The symbol is the lower case Greek letter lambda (λ).
Length	The linear extent in space from one end to the other; the longest dimension of something that is fixed in place
Light-years	The distance that light travels in a vacuum in 1 year; 5.88 trillion miles or 9.46 trillion kilometres
lumen	A unit of luminous flux equal to the amount of light given out through a solid angle of 1 steradian by a point source of 1 candela intensity radiating uniformly in all directions
lux	A unit of illumination equal to 1 lumen per square meter; 0.0929 foot candle
Mach number	The ratio of the speed of a moving body to the speed of sound
Marathon	A traditional unit of distance used in athletics. The length of a marathon is exactly 42 195 meters (about half an inch longer than 26 miles 385 yards).
Marine league	An informal name for the league as used at sea: a unit of distance generally equal to 3 nautical miles (5556 meters).
Mass	The property of a body that causes it to have weight in a gravitational field
maxwell	A cgs unit of magnetic flux equal to the flux perpendicular to an area of 1 square centimetre in a magnetic field of 1 gauss
Metric mile	An informal unit of distance used mostly in athletics. The metric mile is equal to 1500 meters or 1.5 kilometres (approximately 0.932 057 statute mile or 4921.26 feet)
mho	A unit of conductance equal to the reciprocal of an ohm
Microns	A metric unit of length equal to one millionth of a meter

Mole	The molecular weight of a substance expressed in grams; the basic unit of amount of substance adopted under the Système International d'Unités
nail	A former unit of length for cloth equal to 1/16 of a yard
octavo	The size of a book whose pages are made by folding a sheet of paper three times to form eight leaves
oersted	The magnetic field strength 1 cm from a unit magnetic pole
parsecs	A unit of astronomical length based on the distance from Earth at which stellar parallax is 1 second of arc; equivalent to 3.262 light years
Pencil hardness	A traditional measure of the hardness of the "leads" (actually made of graphite) in pencils. The hardness scale, from softer to harder, takes the form ..., 3B, 2B, B, HB, F, H, 2H, 3H, 4H, ... The letters stand for Black, Hard, and Firm. (There is no industry standard defining the scale, so there is some variation between manufacturers in how it is applied.)
Penny	A fractional monetary unit of Ireland and the United Kingdom; equal to one hundredth of a pound
	A coin worth one-hundredth of the value of the basic unit
Perch	A square rod of land
	[Brit, archaic] A linear measure of 16.5 feet
picas	A linear unit (1/6 inch or 4.233 mm) used in printing
points	A linear unit used to measure the size of type; approximately 1/72 inch
Pound	Former British coin worth 20 shilling
Poundal	A unit of force equal to the force that imparts an acceleration of 1 foot/sec/sec to a mass of 1 pound; equal to 0.1382 newtons
Power	the rate of doing work; measured in watts (= joules/second) (physics)
Pressure	The force applied to a unit area of surface; measured in pascals (SI unit) or in dynes (cgs unit)
rad	A unit of absorbed ionizing radiation equal to 100 ergs per gram of irradiated material
Radian	The unit of plane angle adopted under the Système International d'Unités; equal to the angle at the centre of a circle subtended by an arc equal in length to the radius (approximately 57.295 degrees)
radionuclide	A radioactive isotope of an element; produced either naturally or artificially
Rankine	A unit of temperature on the Rankine scale
Shilling	An English coin worth one twentieth of a pound
siemens	A unit of conductance equal to the reciprocal of an ohm

slugs	(g-pounds) A unit of mass equal to the mass that accelerates at 1 foot/sec/sec when acted upon by a force of 1 pound; approximately 14.5939 kilograms
spread rate	The spread rate of a substance is a measure of how much of it there is covering a unit area. The 'how much' can be measured by volume or by mass. The S I compatible unit of spread rate by mass is kilograms/square meter. It is also a measure of area density (mass/unit area)
Square	The product of two equal terms
Steradian	The unit of solid angle adopted under the Système International d'Unités
sthenes	A unit of force equal to 1000 newtons
Stress	(physics) force that produces strain on a physical body
Substance	The real physical matter of which a person or thing consists
Surface Area	The extent of a 2-dimensional surface enclosed within a boundary
Temperature	The degree of hotness or coldness of a body or environment (corresponding to its molecular activity)
tesla	A unit of magnetic flux density equal to one weber per square meter
therms	A unit of heat equal to 100,000 British thermal units
Torque	A twisting force. The S I compatible unit of torque is the newton meter
Troy weight	A system of weights used for precious metals and gemstones; based on a 12-ounce pound and an ounce of 480 grains The troy ounce is the same as the Apothecaries ounce = 480 Avoirdupois grains, (31.1035 grams) in weight.
Volume	The amount of 3-dimensional space occupied by an object
Weber	A unit of magnetic flux equal to 100,000,000 maxwells
Weight	The vertical force exerted by a mass as a result of gravity

S I UNITS

International system of units

In 1960, the General conference on Weights and measure (CGPM) gave official status to a single practical system in S. I. languages.

The International System of units (Systeme International d'Units – SI) is an internationally agreed system of measurement that uses seven base units, with two supplementary units.

All other SI units are derived from the seven base units. In addition, multiples and sub-multiples (fractions) of units are expressed by the use of approved affixes.

Prefixes

The following prefixes, in combination with the basic unit names, provide the multiples and submultiples in the International System. For example, the unit name "meter", with the prefix "kilo" added, produces "kilometre", meaning "1000 meters".

Units	Physical Quantity	Name	Symbol
Base units	Length	Metre	m
	Mass	Kilogram	kilogram
	Time	Second	s
	Electric current	Ampere	A
	Thermodynamic temperature	Kelvin	K
	Luminous intensity	Candela	cd
	Amount of substance	Mole	mol
Supplementary units	Plane angle	Radian	Rad
	Solid angle	Steradian	sr

Definitions of the Seven Basic S I Units

metre (m)

The metre is the basic unit of length. It is the distance light travels, in a vacuum, in 1/299792458th of a second.

kilogram (kg)

The kilogram is the basic unit of mass. It is the mass of an international prototype in the form of a platinum-iridium cylinder kept at Sevres in France. It is now the only basic unit still defined in terms of a material object, and the only one with a prefix [kilo] already in place.

second (s)

The second is the basic unit of time. It is the length of time taken for 9192631770 periods of vibration of the caesium-133 atom to occur.

ampere (A)

The ampere is the basic unit of electric current. Ampere is that current which produces a specified force between two parallel wires, which are 1 metre apart in a vacuum.

It is named after the French physicist Andre Ampere (1775-1836).

kelvin (K)

The kelvin is the basic unit of temperature. It is 1/273.16th of the thermodynamic temperature of the triple point of water.

It is named after the Scottish mathematician and physicist William Thomson 1st Lord Kelvin (1824-1907).

mole (mol)

The mole is the basic unit of substance. mol is the amount of substance that contains as many elementary units as there are atoms in 0.012 kilogram of carbon-12.

candela (cd)

The candela is the basic unit of luminous intensity. It is the intensity of a source of light of a specified frequency, which gives a specified amount of power in a given direction.

(**candela**: The basic unit of luminous intensity adopted under the Système International d'Unités; equal to 1/60 of the luminous intensity per square centimetre of a black body radiating at the temperature of 2,046 degrees Kelvin)

Derived units of the S I

The units of all other physical quantity can be expressed in terms of the seven base units and it is called 'Derived' units. Some of the common derived units are as under:

(From the 7 basic units of the SI other units are derived for a variety of purposes. Only a few are explained here as examples, there are many more.)

farad [F]

The farad is the SI unit of the capacitance of an electrical system, that is, its capacity to store electricity. It is a rather large unit as defined and is more often used as a microfarad. *It is named after the English chemist and physicist Michael Faraday (1791-1867).*

(**Farad**: The capacitance of a capacitor that has an equal and opposite charge of 1 coulomb on each plate and a voltage difference of 1 volt between the plates)

hertz [Hz]

The hertz is the SI unit of the frequency of a periodic phenomenon. One hertz indicates that 1 cycle of the phenomenon occurs every second. For most work much higher frequencies are needed such as the kilohertz [kHz] and megahertz [MHz]. *It is named after the German physicist Heinrich Rudolph Hertz (1857-94).*

(**hertz**: The unit of frequency; one hertz has a periodic interval of one second)

joule [J]

The joule is the SI unit of work or energy. One joule is the amount of work done when an applied force of one newton moves through a distance of 1

meter in the direction of the force. *It is named after the English physicist James Prescott Joule (1818-89).*

(**joule**: A unit of electrical energy equal to the work done when a current of one ampere passes through a resistance of one ohm for one second)

newton [N]

The newton is the SI unit of force. One newton is the force required to give a mass of 1 kilogram an acceleration of 1 meter per second per second. It is named after the English mathematician and physicist Sir Isaac Newton (1642-1727).

(**newton**: A unit of force equal to the force that imparts an acceleration of 1 m/sec/sec to a mass of 1 kilogram; equal to 100,000 dynes)

ohm [Ω]

The ohm is the SI unit of resistance of an electrical conductor. Its symbol is the capital Greek letter 'omega'. It is named after the German physicist Georg Simon Ohm (1789-1854).

(**ohm**: A unit of force equal to the force that imparts an acceleration of 1 m/sec/sec to a mass of 1 kilogram; equal to 100,000 dynes)

pascal [Pa]

The pascal is the SI unit of pressure. One pascal is the pressure generated by a force of 1 newton acting on an area of 1 square meter. It is a rather small unit as defined and is more often used as a kilopascal [kPa]. It is named after the French mathematician, physicist and philosopher Blaise Pascal (1623-62).

(**pascal**: A unit of pressure equal to one newton per square meter)

volt [V]

The volt is the SI unit of electric potential. One volt is the difference of potential between two points of an electrical conductor when a current of 1 ampere flowing between those points dissipates a power of 1 watt. It is named after the Italian physicist Count Alessandro Giuseppe Anastasio Volta (1745-1827).

watt [W]

The watt is used to measure power or the rate of doing work. One watt is a power of 1 joule per second. It is named after the Scottish engineer James Watt (1736-1819).

Note that prefixes may be used in conjunction with any of the above units.

Symbol of S I units

Definition of quantity and Symbol of S I units are tabulated below

Sl.	Unit	Definition of quantity	S. I. units
1	Area	Length square	m^2

Sl.	Unit	Definition of quantity	S. I. units
2	Volume	Length cube	m^3
3	Specific volume	Cubic metre per kilogram	m^3/kilogram
4	Density	Mass per unit volume	kilogram/ m^3
5	Current density	Ampere per square meter	A/m^2
6	Speed	Distance travelled per unit of time	m/s
7	Acceleration	Speed changed per unit time	m/s^2
8	Force	Mass times acceleration of object	kilogram m s^2 (N)
9	Pressure	Force per unit area	kilogram m/s^2 (Pascal = Pa)
10	Energy	Force times distance travelled	kilogram m^2 / s^2 (Joule, J)
11	Magnetic field	Ampere per metre strength	A/m
12	Luminance	Candela per square metre	cd/m^2

Special name of derived units

Unit	Special name of derived SI unit	Symbol	Value in terms of base or supplementary SI units or in terms of other derived SI units
Frequency	hertz	Hz	1/s
Force	newton	N	kilogram•m/s2
Pressure, stress	pascal	Pa	N/m2
Energy, work, qty of heat	joule	J	N•m
Power	watt	W	J/s
Quantity of electricity	coulomb	C	A•s
Electric potential	volt	V	W/A
Capacitance	farad	F	C/V
Electric resistance	ohm	W	V/A
Conductance	siemens	S	A/V
Magnetic flux	Weber	Wb	V•s
Magnetic flux density	tesla	T	Wb/m2
Inductance	henry	H	Wb/A
Luminous flux	lumen	lm	cd•sr
Illuminance	lux	lx	lm/m2
Activity (of radionuclide)	Becquerel	Bq	1/s
Absorbed dose	Gray	Gy	J/kilogram

Units not part of SI units

Certain units that are not part of SI are used so widely that it is impractical to abandon them. The units that are accepted for continued use in the various countries with SI are listed below:

Unit	Sub unit	Symbol	Unit Definition
Time	minute	min	1 minute = 60 seconds
	hour	h	1 hour = 60 minute
	day	d	1 day = 24 hours
Plane angle	degree	°	1° = ( ) radian
	minute	′	1′ = ( )°
	second	″	1″ = ( )′
Volume	liter (or litre)	L	1 L = 1 cubic decimetre (dm^3)
Mass	metric ton	t	1 t = 10^3 kilograms

S I units- prefixes & symbols

Units	**Multiplication Factor**	**Multiple**	**Prefix**	**Symbol**
Septillion fold	1 000 000 000 000 000 000 000 000	= 10^{24}	yotta	Y
sextillion fold	1 000 000 000 000 000 000 000	= 10^{21}	zetta	Z
quintillion fold	1 000 000 000 000 000 000	= 10^{18}	exa	E
quadrillion fold	1 000 000 000 000 000	= 10^{15}	peta	P
trillion fold	1 000 000 000 000	= 10^{12}	tera	T
billion fold	1 000 000 000	= 10^{9}	giga	G
million fold	1 000 000	= 10^{6}	mega	M
thousand	1 000	= 10^{3}	kilo	k
hundred fold	100	= 10^{2}	hecto	h
ten fold	10	= 10^{1}	deka	da
Units	**Multiplication Factor**	**Multiple**	**Affix**	**Symbol**
tenth part	0.1	= 10^{-1}	deci	d
hundredth part	0.01	= 10^{-2}	centi	c
thousandth part	0.001	= 10^{-3}	milli	m
millionth part	0.000 001	= 10^{-6}	micro	µ
billionth part	0.000 000 001	= 10^{-9}	nano	n
trillionth part	0.000 000 000 001	= 10^{-12}	pico	p
quadrillionth part	0.000 000 000 000 001	= 10^{-15}	femto	f
quintillionth part	0.000 000 000 000 000 001	= 10^{-18}	atto	a
sextillionth part	0.000 000 000 000 000 000 001	= 10^{-21}	zepto	z
septillionth part	0.000 000 000 000 000 000 000 001	= 10^{-24}	yocto	y

[µ] the symbol used for micro is the Greek letter known as 'mu'

Nearly all of the S I prefixes are multiples (kilo to yotta) or sub-multiples (milli to yocto) of 1000. However, these are inconvenient for many purposes and so hecto, deca, deci, and centi are also used.

deca also appears as deka [da] or [dk] in the USA and Continental Europe.

Conventions of usage in the S I

There are various rules laid down for the use of the SI and its units as well as some observations to be made that will help in its correct use.

Any unit may take only ONE prefix. For example, 'millimillimetre' is incorrect and should be written as 'micrometer'.

Most prefixes, which make a unit bigger, are written in capital letters (M G T etc.), but when they make a unit smaller then lower case (m n p etc.) is used. Exceptions to this are the kilo [k] to avoid any possible confusion with kelvin [K]; hecto [h]; and deca [da] or [dk]

It will be noted that many units are eponymous, that is they are named after persons. This is always someone who was prominent in the early work done within the field in which the unit is used. Such a unit is written all in lower case (newton, volt, pascal etc.) when named in full, but starting with a capital letter (N V Pa etc.) when abbreviated.

An exception to this rule is the litre which, if written as a lower case 'l' could be mistaken for a '1' (one) and so a capital 'L' is allowed as an alternative. It is intended that a single letter will be decided upon sometime in the future when it becomes clear which letter is being favoured most in use.

Units written in abbreviated form are NEVER pluralized. Therefore, 'm' could always be either 'metre' or 'metres'. 'ms' would represent 'millisecond'.

An abbreviation (such as J N g Pa etc.) is NEVER followed by a full stop unless it is the end of a sentence.

To make numbers easier to read they may be divided into groups of 3 separated by spaces (or half-spaces) but NOT commas.

The SI preferred way of showing a decimal fraction is to use a comma (123,456) to separate the whole number from its fractional part. The practice of using a point, as is common in English-speaking countries, is acceptable providing only that the point is placed ON the line of the bottom edge of the numbers (123.456) and NOT in the middle.

Metric Units (CGS System)

The metric system is a decimal system of weights and measures, adopted first in France, but now widespread over the world. It is universally used in science, mandatory for use for all purposes in a large number of countries.

The basic units are the meter (39.37 inches) for length, and the gram (15.432 grains) for mass or weight.

Derived units are the **litre** for capacity, being the volume of 1000 grams of water under specified conditions. The **'are'** (119.6 square yards) for area, being the area of a square 10 meters on a side, and the **stere** (35.315 cubic feet) for

volume, being the volume of a cube 1 meter on a side, the term stere being, however, usually restricted to measuring fire wood.

The **gramme** or **gram**, the unit of weight, is the weight of a cubic centimetre of distilled water at 4 degree centigrade.

The **meter**, the unit of length, is the ten millionth part of a line drawn from the pole to the equator.

The **litre**, the unit of the measure of capacity, dry, and liquid, is the volume of a cubic decimetre.

The Greek prefixes (deka, centi, kilo, myria) denote multiplication.

The Latin prefixes (deci, centi, milli) denote division.

Millesimal – thousandth part

deka means 10 times	deci means 10th part of
hecto means 100 times	centi means 100th part of
kilo means 1000 times	milli means 1000th part of
myria means 10000 times	micro means millionth part of

Length

Length ( ) is the linear extent in space from one end to the other; the longest dimension of something that is fixed in place.

Millimetre	Centimetre	Decimetre	Metre	Decametre	Hectometre	Kilometre	British
10	1	0.1	0.01	0.001	—	—	0.3937 Inch
100	10	1	0.1	0.01	0.001	—	3.937 Inches
1 000	100	10	1	0.1	0.01	0.001	1.0936 Yards
10 000	1 000	100	10	1	0.1	0.01	10.936 Yards
100 000	10 000	1 000	100	10	1	0.1	109.36 Yards
1 000 000	100 000	10 000	1 000	100	10	1	0.6215 Miles

1000 kilometres = 1 mega metre, One kilometre = 1093.6133 yards

1 metre = 39.370 078 inches =3.280 9 feet = 4 4½

Mass/weight

Mass: The property of a body that causes it to have weight in a gravitational field

Weight ( ): The vertical force exerted by a mass because of gravity

Milli gram	Centi gram	Deci gram	Gram	Deka gram	Hecto gram	Kilo gram	Quintal	Tonne	Equivalent British unit (Avoirdupois)
10	1	0.1	0.01	0.001	0.0001	0.00001			0.15432 grain

Milli gram	Centi gram	Deci gram	Gram	Deka gram	Hecto gram	Kilo gram	Quintal	Tonne	Equivalent British unit (Avoirdupois)
100	10	1	0.1	0.01	0.001	0.0001			1.5432 grain
1000	100	10	1	0.1	0.01	0.001			15.4323 grain
	1000	100	10	1	0.1	0.01			5.6438 dram
		1000	100	10	1	0.1			3.5274 ounce
			1000	100	10	1	0.01	0.001	2.205 pound
					1000	100	1	0.1	220.46 pound
						1000	10	1	2204.60 pound

1 mega gram = 100 kilogram. One myria gram = 10 kilograms.
70 kilograms = 11 stones; 1 quintal = 2.2046; cental=1.9684 hundredweight
1 kilogram =1 seer 6 tola, or 86 tola (1 seer = 80 tola)
1 kilogram = 15432 grains or 35.27 oz or 2 lbs 3 oz or 0.0199 cwt

Area

Area (   ) is the extent of a 2-dimensional surface enclosed within a boundary

Square millimetre	Square centimetre	Square decimetre	Square metre	Are	hectare	Square kilometre	Equivalent British unit
100	1	0.01					0.155 square inch
10 000	100	1	0.01				15.50 square inches
	10 000	100	1	0.01			10.764 square feet
		10 000	100	1	0.01		119.60 square yards
			10000	100	1	0.01	11960 square yards
			1000000	10000	100	1	0.3861 square mile

1centare = 1/100th of an are

Volume

Volume is the amount of 3-dimensional space occupied by an object

The distinction between 'Volume' and 'Capacity' is artificial and kept here only for historic reasons. (One thousand cubic millilitres is a cubic centimetre and a cubic decimetre is a litre).

Cubic millimetre	Cubic centimetre	Cubic decimetre	Cubic metre	Equivalent British unit
1000	1	0.001		0.061 023 74 cubic inch
	1 000	1	0.001	61.023 7 cubic inches
	1 000 000	1000	1	35.314 67 cubic feet

1 cubic metre = 1000 litres.

One milliard equals one cubic kilometre, which is 1 billion (10^9) cubic meters or about 810 767 acre feet.

Liquid measure/Capacity

Millilitre	Centilitre	Decilitre	Litre	Dekalitre	Hectolitre	Kilolitre	Equivalent British unit
10	= 1	= 0.1	= 0.01	= 0.001	→	→	0.0704 gill
100	= 10	= 1	= 0.1	= 0.01	=0.001	= 0.0001	0.17598 pint
1000	= 100	= 10	= 1	= 0.1	= 0.01	= 0.001	0.22 gallon
10000	= 1000	= 100	= 10	= 1	= 0.1	= 0.01	2.19975 gallons
100000	= 10000	= 1000	= 100	= 10	= 1	= 0.1	21.9975 gallons
1000000	= 100000	= 10000	= 1000	= 100	= 10	= 1	2199.75 gallons

50 ounces = 1500 millilitres; 1 centilitre = 0.07 gill; 1 hectolitre = 2.75 bushels;

1 litre=0.224 411984 gallon UK or =0.264 172 052 gallon US; 1000 litres = 1 stere

1 litre = 1.761pint UK (or 2.1277 pint US)or 0.88 quart or 0.22 gal or 0.275 bushel

Name→	Millilitre	Centilitre	Decilitre	Litre	Dekalitre	Hectolitre	Kilolitre
Number of litres	0.001	0.01	0.1	1	10	100	1000
Cubic measure	1 cu cm	10 cu cm	0.1cu dm	1 cu dm	10 cu dm	0.1 cu m	1 cu m

Universal measures

Blood

One unit blood = 350 millilitre

Gems & jewellery

Carat or Karat is a unit of weight in gemstones, 200 milligrams (about 3 grains of troy or avoirdupois weight)

1 carat or karat	=3.17 grains (about 0.0071 ounce)
1 metric carat	=200 milligrams (0.20 gram)
1 point	=0.01 carat or exactly 2 milligrams
1 Pearl grain (or metric grain)	=¼ carat or 50 milligrams
1 momme	=3.75 grams (about 0.132 ounce) or 18.75 carats (Japanese wt unit for cultured pearls)
Ratti ( )	= 122 milligram(Astrologers use for gems) but jewellers treat it as 180 milligram

Another unit used to express the weight of diamonds is the point, a weight equal to 0.01 carat. A stone of 82 points would therefore weigh 0.82 carat

Circular measures

1 second = 1/1 296 000 of the circumference of a circle

60 seconds (") = 1 minute (') =1/21 600 of the circumference of a circle

60 minutes (′)	= 1 degree (°)	= 0.01745 radians
30°	= 1 zodiac sign	= 0.5235 radians
57.2958°	= 1 radian	= 57 °17′44.8″
90°	= 1 quadrant or right angle	
180°	= 1 straight angle	
360°	= 1 circle or circumference	= 4 quadrants
Arc	=1/360 of the circumference of a circle, or the central angle subtended by such an arc	

There are 2 π radians, or approx 6.28 radians in 360°

When the length of an arc is equal to the radius of the circle of which the arc is part, the length is called one radian.

Milli-radian = 1/1000 of a radian (A unit of angular distance)

Geographical measure

1° Geographical =364,566.929 feet =69.047 miles (average) =111.123 kilometres (average)

1° Geographical of *latitude = 110568.18 metres (68.708 Statute miles) at equator & 69.403 miles at pole

1° Geographical of **longitude =112.09 kilometres (69.65 miles) at equator

1 Geographical mile =6080 feet = 1853.184 metres (800 feet longer than a statute mile)

1 Geographical mile =   or 0.06666666 of 1° at Equator

1 Geographical mile = 1 nautical mile

* An imaginary line around the Earth parallel to the equator

** The angular distance between a point on any meridian and the prime meridian at Greenwich

Shipping measure

Cargo- Table 1

Internal capacity	Measurement of cargo	
One register ton	=1 US shipping ton	=100 cubic feet
100 cubic feet	=40 cubic feet	=32.143 US bushels

Cargo- Table 2

Shipping ton (US) or 1 ton of freight	= 40 cu ft merchandise (32.143 bushels)	= 1.133 cu metres
Shipping ton	= 42 cu feet (1.1893 cubic metres)	= 1.18 cu metres
Ton of displacement of ship	= 35 cu feet (one cubic metre)	= 1.02 cu metres

Interrelation of Units of Measurement

Units of length, area, and survey measures of the international are included in the tables given on the next page and onwards. (*Indicates exact values)

Units of Length

Units	Inches	Links	Feet	Yards	Rods	Chains	Miles	Centimetre	Meters
1 inch	1*	0.126263	0.083333	0.027778	0.005051	0.001263	0.000016	2.54*	0.0254*
1 link	7.92*	1	0.66*	0.22*	0.04*	0.01	0.000125	20.117	0.201168
1 foot	12*	1.515152	1*	0.333333	0.060606	0.015152	0.000189	30.48*	0.3048*
1 yard	36*	4.54545	3*	1*	0.181818	0.045455	0.000568	91.44*	0.9144*
1 rod	198*	25*	16.5*	5.5*	1*	0.25*	0.003125*	502.92	5.0292
1 chain	792*	100*	66*	22*	4*	1*	0.0125*	2011.68	20.1168
1 mile	63 360*	8000*	5280*	1760*	320*	80*	1*	160934.4*	1609.344*
1 centimetre	0.3937	0.049710	0.032808	0.010936	0.001988	0.000497	0.000006	1*	0.01*
1 meter	39.37	4.970960	3.280840	1.093613	0.198838	0.049710	0.000621	100*	1*

Units of area

Units	Square inch	Square links	Square feet	Square yard	Square rod	Square chain
1 square inch	1	0.0159423	0.006944	0.000771605	0.000 0255	0.000001594
1 square link	62.726 4	1	0.435 6*	0.0484*	0.0016*	0.000 1
1 square foot	144*	2.295684	1*	0.1111111	0.003 67309	0.000229568
1 square yard	1296*	20.66116	9*	1*	0.033 05785	0.00206612
1 square rod	39 204*	625*	272.25*	30.25*	1*	0.0625
1 square chain	627 264*	10000*	4356*	484*	16*	1*
1 acre	6 272640*	100000*	43 560*	4840*	160*	10*
1 square mile	4 014489 600*	64000000*	27878400*	3 097600*	102 400*	6400*
1 square centimetre	0.155000 3	0.00247105	0.001 076	0.000119599	0.000 003954	0.000000247
1 square meter	1550.003	24.71044	10.763 91	1.195990	0.039 53670	0.002471044
1 hectare	15 500031	247104	107639.1	11959.90	395.3670	24.71044*

Table 2

Units	Acre	Square mile	Sq centimetre	Square metre	Hectare
1 square inch	0.000000159423	0.00000000024910	6.451 6*	0.00064516*	0.000000065
1 square link	0.00001*	0.000000015625*	404.68564224	0.04046856	0.000004047
1 square foot	0.000022 95684	0.00000003587006	929.0341	0.09290341	0.000009290
1 square yard	0.000206 6116	0.0000003228306	8361.2736*	0.83612736	0.000083613
1 square rod	0.00625*	0.000009765625*	252 929.5	25.29295	0.002529295
1 square chain	0.1*	0.00015625*	4046873	404.6873	0.04046873
1 acre	1*	0.0015625*	40468730	4046.873	0.4046873
1 square mile	640*	1*	25899881103	2 589988.11	258.998811034
1 square cm	0.000000024711	0.000000000038610	1*	0.000 1*	0.00000001*
1 square meter	0.0002471044	0.0000003861022	10 000*	1*	0.0001*
1 hectare	2.471044	0.003861006	100 000 000*	10 000*	1*

Weight or mass not greater than pound & kilogram

Table1

Units	Grains	Pennyweights	Avoirdupois drams	Avoirdupois ounces
1 grain	1*	0.04166667	0.03657143	0.00228571

Units	Grains	Pennyweights	Avoirdupois drams	Avoirdupois ounces
1 pennyweight	24*	1*	0.8777143	0.05485714
1 dram Avoirdupois	27.34375*	1.139323	1*	0.0625*
1 ounce Avoirdupois	437.5*	18.22917	16*	1*
1 ounce troy	480*	20*	17.55429	1.097143
1 pound troy	5760*	240*	210.6514	13.16571
1 pound Avoirdupois	7000*	291.6667	256*	16*
1 milligram	0.015432	0.000643015	0.000564383	0.000035274
1 gram	15.43236	0.6430149	0.5643834	0.03527396
1 kilogram	151432.36	643.0149	564.3834	35.27396

Table 2

Units	Troy ounce	Troy pound	Av pound	Milligram	Gram	Kilogram
1 grain	0.00208333	0.000173611	0.000142857	64.79891*	0.06479891*	0.000064799
1 pennyweight	0.05*	0.004166667	0.003428571	1555.17384*	1.55517384*	0.001555174
1 dram av	0.05696615	0.004747179	0.00390625	1771.845195	1.771845195	0.001771845
1 ounce av	0.9114583	0.07595486	0.0625	28349.523125*	28.349523125*	0.02834952
1 ounce troy	1*	0.083333333	0.06857143	31103.4768*	31.1034768*	0.03110348
1 pound troy	12*	1*	0.8228571	373241.7216*	373.2417216*	0.373241722
1 pound av	14.58333	1.215 278	1*	453592.37*	453.59237*	0.45359237*
1 milligram	0.000032151	0.000002679	0.000002205	1*	0.001*	0.000001*
1 gram	0.03215075	0.002679229	0.002204623	1000*	1*	0.001*
1 kilogram	32.15075	2.679229	2.204623	1000000*	1000*	1*

Weight or mass not Less than avoirdupois ounce

Units	av ounce	av pound	Short cwt	Short tons	Long tons	Kilograms	Metric tons
1 ounce av	1*	0.0625*	0.000 625*	0.00003125*	0.000027902	0.028349 523	0.000028350
1 pound av	16*	1*	0.01*	0.0005*	0.000446429	0.453592 37*	0.000453592
1 short cwt	1600*	100*	1*	0.05*	0.04464286	45.359237*	0.045359237*
1 short ton	32000*	2000*	20*	1*	0.8928571	907.18474*	0.90718474*
1 long ton	35840*	2240*	22.4*	1.12*	1*	1016.0469088*	1.016046909
1 kilogram	35.27396	2.204623	0.02204623	0.001102311	0.000984207	1*	0.001*
1 metric ton	35 273.96	2204.623	22.04623	1.102311	0.984206 5	1000*	1*

Units of Volume

Units	Cubic in	Cubic feet	Cubic yard	Cubic cm	Cubic dm	Cubic m
1 cubic inch	1*	0.000578704	0.000021433	16.387064*	0.016387	0.000016387
1 cubic foot	1728*	1*	0.03703704	28 316.846592*	28.316847	0.028316847
1 cubic yard	46 656*	27*	1*	764 554.857984*	764.554858	0.764554858
1 cubic centimetre	0.06102374	0.000035315	0.000001308	1*	0.001*	0.000001*
1 cubic dekametre	61.02374	0.035 31467	0.001307951	1000*	1*	0.001*
1 cubic meter	61 023.74	35.31467	1.307 951	1 000 000*	1000*	1*

Conversion of Units

Those marked with * are exact. Other values are given to an appropriate degree of accuracy.

Length

The SI unit of length is the metre. To change any of these other units of length into their equivalent values in metres use the operation and conversion factor given.

angstroms	metric unit of length equal to one ten billionth of a meter (or 0.0001 micron); used to specify wavelengths of electromagnetic radiation	divide by 10 000 000 000 *
astronomical units	mean distance of the earth from the sun	× 149598550000
barleycorns	1/3 of an inch	× 0.008 467
centimetres	A metric unit of length equal to one hundredth of a meter	× 0.01 *
chains (surveyors')	100 link (1 link = 7.92 inches)	× 20.1168 *
cubits	length of forearm from elbow to tip of middle finger	× (0.45 to 0.5)
ells (UK)	former measure of length varying in different countries	× 0.875 (many variations)
em (pica)	12 point type of a size (linear unit (1/6 inches) used in printing)	× 0.004 233 3
fathoms	linear unit of measurement (equal to 6 feet) for water depth	× 1.8288 *

feet	A linear unit of length equal to 12 inches or a third of a yard	× 0.3048 *
feet (US survey)		× 0.304 800 609 6
furlongs	length of a furrow equal to 220 yards	× 201.168 *
hands	unit of length equal to 4 inches; used in measuring horses	× 0.1016 *
Inches	A unit of length equal to one twelfth of a foot	× 0.0254 *
Kilometres	A metric unit of length equal to 1000 meters (or 0.621371 miles)	× 1000 *
leagues	obsolete unit of distance of variable length (usually 3 miles)	× (4000 to 5000)
light years	distance traversed by light in one mean solar year	× 9460500000000000
links (surveyor's)	A unit of length equal to 1/100 of a chain	× 0.201 168 *
metres (m)		1
microns (micrometers)	A metric unit of length equal to one millionth of a meter	× 0.000 001 *
miles	unit of length equal to 1,760 yards or 5,280 feet	× 1609.344 *
miles (nautical)	A unit of length used in navigation; exactly 1,852 meters; historically based on the distance spanned by one minute of arc in latitude	× 1852 *
parsecs	distance equal to 206,265 times the distance from earth to son or 3.262 light years	× 30856770000000000
perch (rods or poles)	A linear measure of 16.5 feet	× 5.0292 *
pica (computer)		× 0.004 233 333
picas (printer's)	linear unit (1/6 inches) used in printing	× 0.004 217 518
points (computer)		× 0.000 352 777 8
points (printer's)	linear unit used to measure the size of type; approximately 1/72 inches	× 0.000 351 459 8
yards	originally taken to be the average length of a stride	× 0.9144 *

Various units of length

Description		Equivalent	
1 Astronomical unit	Distance between centre of earth and centre of sun. (Au)	Giga metres	149.59787
1 League	International Nautical or Marine league (3 nautical miles)	Kilometre	5.556
1 League	UK Nautical	Kilometre	5.559552
1 League	US	Kilometre	4.828032
1 Light year	The distance that light travels in a vacuum in 1 year; 5.88 trillion miles or 9.46 trillion km	Peta metres	9.4605
1 Micron	μ m (millionth part of a metre)	Micro-metre	1.00
1 Mile	International Nautical	Kilometre	1.852
1 Mile	UK Nautical	Kilometre	1.853184
1 Parsec	3.26 light years	Peta metres	30.857
1 Pica	a unit of distance used by typesetters and printers (0.1780 inch)	Millimetres	4.217518
1 Point	a unit of length used by typographers and printers (0.013837 inch)	Millimetre	0.3514598

Area

The SI unit of area is the square metre. To change any of these other units of area into their equivalent values in square metres use the operation and conversion factor given.

acres	× 4046.856 422 4 *
are	× 100 *
circular inches	× 0.000 506 707 479
hectares	× 10 000 *
hides	× 485 000 (with wide variations)
roods	× 1011.714 105 6 *
square centimetres	× 0.000 1 *
square feet	× 0.092 903 04 *
square feet (US survey)	× 0.092 903 411 613
square inches	× 0.000 645 16 *
squares (of timber)	× 9.290 304 *
square kilometres	× 1 000 000 *
square metres	1
square miles	× 2 589 988.110 336 *
square millimetres	× 0.000 001 *

square rods (or poles)	× 25.292 852 64 *
square yards	× 0.836 127 36 *
townships	× 93 239 571.972

Volume/capacity

The S I unit of volume is the cubic metre. To change any of these other units of volume into their equivalent values in litres use the operation and conversion factor given.

Litre

Here the litre = a cubic decimetre.

barrels (oil)	× 158.987 294 928 *
bushels (UK)	× 36.368 72 *
bushels (US)	× 35.239 070 166 88 *
centilitres	× 0.01 *
cubic centimetres	× 0.001 *
cubic decametres	× 1 000 000 *
cubic decimetres	1
cubic feet	× 28.316 846 592 *
cubic inches	× 0.016 387 064 *
cubic metres	× 1000 *
cubic millimetres	× 0.000 001 *
cubic yards	× 764.554 857 984 *
decilitres	× 0.1 *
fluid ounces (UK)	× 0.028 413 062 5 *
fluid ounces (US)	× 0.029 573 529 562 5 *
gallons (UK)	× 4.546 09 *
gallons, dry (US)	× 4.404 883 770 86 *
gallons, liquid (US)	× 3.785 411 784 *
litres	1
litres (1901 - 1964)	× 1.000 028
millilitres	× 0.001 *
pints (UK)	× 0.568 261 25 *
pints, dry (US)	× 0.550 610 471 357 5 *
pints, liquid (US)	× 0.473 176 473 *
quarts (UK)	× 1.136 522 5 *
quarts, dry (US)	× 1.101 220 942 715 *
quarts, liquid (US)	× 0.946 352 946 *

Mass (or Weight)

The S I unit of mass is the kilogram. To change any of these other units of mass into their equivalent values in kilograms use the operation and conversion factor given.

carats, metric	× 0.000 2 *
grains	× 0.000 064 798 91 *
grams	× 0.001 *
hundredweights, long	× 50.802 345 44 *
hundredweights, short	× 45.359 237 *
kilograms	1
ounces, avoirdupois	× 0.028 349 523 125 *
ounces, troy	× 0.031 103 476 8 *
pounds	× 0.453 592 37 *
slugs (or g-pounds)	× 14.593 903
stones	× 6.350 293 18 *
tonnes	× 1000 *
tons (UK or long)	× 1016.046 908 8 *
tons (US or short)	× 907.184 74 *

Line density

Line density is a measure of mass per unit length. The S I compatible unit of line density is kilograms/metre. A major use of line density is in the textile industry to indicate the coarseness of a yarn or fibre. For that purpose the SI unit is rather large so the preferred unit there is the Tex. (1 tex = 1 gram/kilometre). To change any of these other units of line density into their equivalent values in kilograms/metre use the operation and conversion factor given.

denier	divide by 9 000 000 *
drex	divide by 10 000 000 *
grams/centimetre	divide by 10 *
grams/kilometre (tex)	divide by 1 000 000 *
grams/metre	divide by 1000 *
grams/millimetre	1
kilograms/kilometre	divide by 1000 *
kilograms/metre	1
milligrams/centimetre	divide by 10 000 *
milligrams/millimetre	divide by 1000 *
ounces/foot	× 0.093 01
ounces/inch	× 1.116 125
pounds/foot	× 1.488 164
pounds/inch	× 17.858
pounds/mile	× 0.000 281 849

pounds/yard	× 0.496 055
tonnes/kilometre	1
tons(UK)/mile	× 0.631 342
tons(US)/mile	× 0.563 698

Density

Density is a measure of mass per unit volume. The S I compatible unit of density is kilograms/cubic metre. However, this rather large unit for most purposes (iron is over 7000, wood is about 600 and even cork is over 200). A much more useful size of unit is kilograms/litre (for which the previous values then become 7, 0.6, and 0.2 respectively). This unit also has the great advantage of being numerically unchanged for grams/cubic centimetre and tonnes/cubic metre (or mega grams/cubic metre). To change any of these

Other units of density into their equivalent values in kilograms/litre use the operation and conversion factor given.

grains/gallon (UK)	divide by 70 157
grains/gallon (US)	divide by 58 418
grams/cubic centimetre	1
grams/litre	divide by 1000 *
grams/millilitre	1
kilograms/cubic metre	divide by 1000 *
kilograms/litre	1
mega grams/cubic metre	1
milligrams/litre	divide by 1 000 000 *
milligrams/millilitre	divide by 1000 *
ounces/cubic inch	× 1.729 994 044
ounces/gallon(UK)	× 0.006 236 023
ounces/gallon(US)	× 0.007 489 152
pounds/cubic foot	× 0.016 018 463
pounds/cubic inch	× 27.679 905
pounds/gallon(UK)	× 0.099 776 373
pounds/gallon(US)	× 0.119 826 427
tonnes/cubic metre	1
tons(UK)/cubic yard	× 1.328 939 184
tons(US)/cubic yard	× 1.186 552 843

Energy or work

There is a lot of confusion in some of the units used here. The calorie can take 5 different values and, while these do not vary by very much, for accurate work it is necessary to specify which calorie is being used.

The Five calories are known as the:

1. International Table calorie = cal (IT)

2. Thermo chemical calorie = cal (th)
3. Mean calorie = cal (mean)
4. 15 degree C calorie = cal (15C)
5. 20 degree C calorie = cal (20C).

Unless a clear statement is made saying otherwise, assume the IT calorie is being used.

As a further complication, in working with food and expressing nutritional values, the unit of a Calorie (capital C) is often used to represent 1000 calories, and again it is necessary to specify which calorie is being used for that.

The British thermal unit (BTU) can also take different values and they are named in a similar way to the calorie, that is BTU (IT), (th), etc. Also note that the therm is 100 000 BTU so its exact size depends on which BTU is being used.

The S I unit of energy or work is the joule. To change any of these other units of energy or work into their equivalent values in joules use the operation and conversion factor given.

British thermal units(IT)	× 1055.056
BTU (mean)	× 1055.87
BTU (thermal)	× 1054.350
calories - cal (IT)	× 4.1868 *
- cal (mean)	× 4.190 02
- cal (20C)	× 4.181 90
- cal (thermal)	× 4.184 *
- cal (15C)	× 4.185 80
Calorie (food)	× 4186 (approx.)
centigrade heat units	× 1900.4
ergs	divide by 10 000 000 *
foot pounds-force	× 1.355 818
foot poundals	× 0.042 140
gigajoules (GJ)	× 1000 000 000 *
horsepower hours	× 2 684 520 (approx.)
joules (J)	1
kilocalories (IT)	× 4186.8 *
kilocalories (thermal)	× 4184 *
kilogram-force metres	× 9.806 65 *
kilojoules (kJ)	× 1000 *
kilowatt hours (kWh)	× 3 600 000 *
mega-joules (MJ)	× 1 000 000 *
newton metres (Nm)	× 1 *
therms	× 105 500 000 (approx.)
watt seconds (Ws)	1
watt hours (Wh)	× 3600 *

Force

The S I unit of force is the newton. To change any of these other units of force into their equivalent values in newton use the operation and conversion factor given.

dynes	divide by 100 000*
kilograms force	× 9.806 65*
kilo-newton (kN)	× 1000 *
kips	× 4448.222
mega-newton (MN)	× 1 000 000*
newton (N)	1
poundals	× 0.138 255
pounds force	× 4.448 222
tonnes force	× 9806.65*
tons(UK) force	× 9964.016
tons(US) force	× 8896.443

Fuel Consumption

Fuel consumption of any means of transport (car, aeroplane, ship etc.) that uses fuel is a measure giving the relationship between the distances travelled for an amount of fuel used. The most common example is the car where it is usually expressed (in English-speaking countries) in miles per gallon.

Fuel consumption is expressed in gallons per mile. However, for a car the latter method gives a rather small figure: 35 miles per gallon is about 0.0286 gallons per mile. In that case, it would be better to give a figure for 100 miles, so it would be 2.86 gallons per 100 miles. That is the metric way of expressing fuel consumption - as litres per 100 kilometres.

All the values are given to an accuracy of 4 significant figures

To change	Into	Operation
miles per gallon (UK)	miles per gallon (US)	multiply by 0.833
miles per gallon (UK)	miles per litre	multiply by 0.22
miles per litre	miles per gallon (UK)	multiply by 4.546
miles per gallon (UK)	kilometres per litre	multiply by 0.354
miles per gallon (US)	miles per gallon (UK)	multiply by 1.2
miles per gallon (US)	miles per litre	multiply by 0.2642
miles per litre	miles per gallon (US)	multiply by 3.785
miles per gallon (US)	kilometres per litre	multiply by 0.4251
X miles per gallon	gallons per 100 miles	divide 100 by X (both gallons must of the same type)
X km per litre	litres per 100 km	divide 100 by X
X miles per gallon (UK)	litres per 100 km	divide 282.5 by X

To change	Into	Operation
X miles per gallon (US)	litres per 100 km	divide 235.2 by X
X miles per litre	litres per 100 km	divide 62.14 by X

Power

Since power is a measure of the rate at which work is done, the underlying units are those of work or energy, and that section should be looked at for explanations concerning the calorie and BTU. In this section, the (IT) values have been used.

In this section, the horsepower provides confusion. Just like the calorie, it can take 5 different values, and these are identified as necessary by the addition of (boiler), (electric), and (metric), (UK) and (water). Unlike the calorie (whose 5 values are reasonably close to each other), the horsepower has 4 which are close and 1 (boiler) which is considerably different - it is about 13 times bigger than the others - but it seems to be very little used.

The SI unit of power is the watt. To change any of these other units of energy or work into their equivalent values in watts use the operation and conversion factor given.

BTU/hour	× 0.293 071
BTU/minute	× 17.584 267
BTU/second	× 1055.056
calories/hour	× 0.001 163 *
calories/minute	× 0.069 78 *
calories/second	× 4.1868 *
feet lb-force/minute	× 0.022 597
feet lb-force/second	×1.355 82
giga-watts (GW)	× 1 000 000 000
horsepower (electric)	× 746 *
horsepower (metric)	× 735.499
joules/hour	divide by 3600 *
joules/minute	divide by 60 *
joules/second	1
kilogram-force metres/hour	× 0.002 724
kilogram-force metres/minute	× 0.163 444
kilocalories/hour	× 1.163
kilocalories/minute	× 69.78
kilowatts (kW)	× 1000 *
megawatts (MW)	× 1 000 000 *
watts (W)	1

Pressure or Stress

The SI unit of pressure is the pascal. The units of pressure defined in the same way as those for stress - force/unit area. To change any of these other units of pressure (or stress) into their equivalent values in Pascal use the operation and conversion factor given. Those marked with * are exact. Other values are given to an appropriate degree of accuracy. Measures based on water assume a density of 1 kilogram/litre - a value that is rarely matched in the real world, though the error is small.

atmospheres	× 101 325 *
bars	× 100 000 *
centimetres of mercury	× 1333.22
centimetres of water	× 98.066 5 *
feet of water	× 2989.066 92 *
hecto-pascal (hPa)	× 100 *
inches of water	× 249.088 91 *
inches of mercury	× 3386.388
kilogram-force/square centimetre	× 98 066.5 *
kilogram-force/square metre	× 9.806 65 *
kilo-newton/square metre	× 1000 *
kilopascal (kPa)	× 1000 *
kip/square inch	× 6 894 760
mega newton/square metre	× 1 000 000 *
metres of water	× 9806.65 *
milli-bars	× 100 *
pascal (Pa)	1
millimetres of mercury	× 133.322
millimetres of water	× 9.806 65 *
newton/square centimetre	× 10 000
newton/square metre	1
newton/square millimetre	× 1 000 000 *
pounds-force/square foot	× 47.880
pounds-force/square inch	× 6894.757
poundals/square foot	× 1.448 16
tons(UK)-force/square foot	× 107 252
tons(UK)-force/square inch	× 15 444 256
tons(US)-force/square foot	× 95 760
tons(US)-force/square inch	× 13 789 500
tonnes-force/square cm	× 98 066 500 *
tonnes-force/square metre	× 9806.65*

Speed

The SI compatible unit of speed is metres/second. To change any of these other units of speed into their equivalent values in metres/second use the operation and conversion factor given.

centimetres/minute	divide by 6000 *
centimetres/second	divide by 100 *
feet/hour	divide by 11 811
feet/minute	× 0.005 08 *
feet/second	× 0.3048 *
inches/minute	divide by 2362.2
inches/second	× 0.0254 *
kilometres/hour	divide by 3.6 *
kilometres/second	× 1000 *
knots	× 0.514 444
Mach number	× 331.5
metres/hour	divide by 3600 *
metres/minute	divide by 60 *
metres/second (m/s)	1
miles/hour	× 0.447 04 *
miles/minute	× 26.8224 *
miles/second	× 1609.344 *
yards/hour	divide by 3937
yards/minute	× 0.015 24 *
yards/second	× 0.9144 *

Spread rate (by mass)

The spread rate of a substance is a measure of how much of it there is covering a unit area. The 'how much' can be measured by volume or by mass. The S I compatible unit of spread rate by mass is kilograms/square metre. It is also a measure of area density (mass/unit area) and is similar to - but not the same as - pressure, which is force/unit area. For the rainfall conversions a density of 1 kilogram/litre has been assumed. To change any of these other units of spread rate into their equivalent values in kilograms/square metre use the operation and conversion factor given. Those marked with * are exact. Other values are given to an appropriate degree of accuracy.

grams/square centimetre	× 10 *
grams/square metre	divide by 1000 *
inches of rainfall	× 2.54
kilograms/hectare	divide by 10 000 *
kilograms/square centimetre	× 10 000 *
kilograms/square metre	1

milligrams/square metre	divide by 1000 *
millimetres of rainfall	1
ounces/square foot	× 0.305 152
ounces/square inch	× 43.942
ounces/square yard	divide by 49.494
pounds/acre	divide by 8921.791
pounds/square foot	× 4.882 428
pounds/square inch	× 703.07
pounds/square yard	× 0.542 492
tonnes/hectare	divide by 10 *
tons(UK)/acre	divide by 3.982 942
tons(US)/acre	divide by 4.460 896

Spread Rate (by volume)

The spread rate of a substance is a measure of how much of it there is covering a unit area. The 'how much' can be measured by volume or by mass. The S I compatible unit of spread rate by volume is cubic metres/square metre.

cubic feet/acre	divide by 142.913
cubic inches/square yard	divide by 51.024
cubic metres/hectare	divide by 10 *
cubic metres/square km	divide by 1000 *
cubic metres/square metre	× 1000 *
cubic yards/square mile	divide by 3387.577
fluid ounces(UK)/square yard	divide by 29.428
gallons(UK)/acre	divide by 890.184
gallons(UK)/hectare	divide by 2199.692
gallons(US)/acre	divide by 1069.066
gallons(US)/hectare	divide by 2641.721
inches of rainfall	× 25.4 *
litres/hectare	divide by 10 000 *
litres/square metre	1
millilitres/square metre	divide by 1000 *
millimetres of rainfall	1

Torque

The S I compatible unit of torque is the newton metre. To change any of these other units of torque into their equivalent values in newton metres use the operation and conversion factor given.

dyne centimetres	divide by 10 000 000 *
gram-force centimetres	× 0.000 098 066 5 *
kilogram-force centimetres	× 0.098 066 5 *
kilogram-force metres	× 9.806 65 *

newton centimetres	divide by 100 *
newton metres (Nm)	1
ounce-force inches	divide by 141.612
pound-force inches	× 0.112 984
pound-force feet	× 1.355 818
poundal feet	× 0.042 140
ton(UK)-force feet	× 3 037.032
ton(US)-force feet	× 2 711.636
tonne-force metres	× 9 806.65 *

Accuracy

Where the given value is an exact one then it has been signalled. In most cases other values are accurate to at least the number of significant figures shown. In some cases it might be more than that as trailing zeros have not been included.

Inverse usage

In nearly all cases, the conversion factors have been given to change 'non-standard' units into standard units of the SI. For those cases where it is necessary to do a conversion the other way, it is only a matter of reversing the operation. For example to convert feet into metres, you multiply by 0.3048 so, to convert metres into feet you divide by 0.3048. Following on from this it can be seen how conversions can be made between non-standard units, changing first into the standard unit and then back into the required unit.

Conversion factors

Conversion factors are factors by which a quantity that is expressed in one set of units must be multiplied in order to convert it into another set of units.

British to metric & vice versa

Description	British unit	Metric unit	Conversion factors (×)	
	FPS System	CGS System	FPS to CGS	CGS to FPS
Length	inch	centimetre	2.54	0.395
	feet	metre	0.305	3.281
	yard	metre	0.914	1.094
	furlong	kilometre	0.2012	4.9712
	mile	kilometre	1.609	0.6214
	sea mile	kilometre	1.8538	0.5394
Area	square inch	square centimetre	6.452	0.155
	square feet	square metre	0.0929	10.7639
	square yard	square metre	O.83613	1.196
	acre	square metre	4046.89	0.000247
	acre	hectare	0.4047	2.471
	square mile	hectare	259	0.00386
	square mile	square kilometre	2.59	0.3861
	square mile	square metre	2590007.42	0.000000386
Volume	cubic inch	cubic centimetre	16.3871	0.06102
	cubic feet	cubic metre	0.02831	35.316
	cubic yard	cubic metre	0.7645	1.308
	gallons	cubic metre	0.004546	220
	acre-foot	hectare-metre	0.1234	8.1071
Capacity	cubic inch	litres	0.0164	61.0255
	cubic foot	litre	28.3161	0.0353
	pint	cubic metre	0.0005682	27.5
	gallon	litre	4.546	0.22
Linear Velocity	feet per second	kilometre per hour	1.0973	0.9113
	feet per second	metre per second	0.305	3.28
	feet per second	metre per second	18.29	0.547
	feet per minute	centimetre per second	0.508	1.9685
	feet per minute	metre per second	0.0051	196.85
	feet per minute	kilometre per hour	0.0183	54.68
Linear Velocity	mile per hour	kilometre per hour	1.609	0.6214
	mile per hour	metre per second	0.4470	2.237
	mile per hour	knot	0.8684	1.1515
	knot	kilometre per hour	1.8532	0.5396

Description	British unit	Metric unit	Conversion factors (×)	
	FPS System	CGS System	FPS to CGS	CGS to FPS
	knot	metre per second	0.51453	1.9435
Consumption	gallon per mile	litre per kilogram	2.825	0.354
	mile per gallon	kilogram per litre	0.354	2.825
	cu feet per minute	litre per second	0.4720	2.1186
	gallons per hour	litre per minute	0.076	13.1985
Density (linear)	pound per inch	gram per centimetre	178.58	0.0056
	pound per inch	kilogram per metre	17.858	0.056
	pound per foot	gram per centimetre	14.882	0.0672
	pound per foot	kilogram per metre	1.488	0.672
	pound per yard	gram per centimetre	4.961	0.2016
	pounds per yard	kilogram per metre	0.4961	2.0159
Density (mass per volume)	grain /cubic inch	gram /cubic centimetre	0.039541	252.91
	pound /cubic inch	gram /cubic centimetre	27.68	0.0361
	pound /cubic inch	kilogram /cubic cm	0.0277	36.125
	pound /cubic feet	gram /cubic centimetre	0.016	62.43
	pound /cubic feet	kilogram /cubic metre	16.0185	0.0624
	pound /cubic feet	gram per litre	16.0185	0.0624
Force	poundal	dynes	13825.25	0.00007233
Pressure & stress	pounds/square inch	gram /square centimetre	70.307	0.0142
	pounds/square inch	kilogram /sq centimetre	0.0703	14.2233
	pound/square inch	kilogram /square metre	703.07	0.00142
	pounds/square inch	tonne /square metre	0.7031	1.4223
	pound/square feet	gram /square centimetre	0.4882	2.0487
	pound/square feet	kilogram/square metre	4.8824	0.20481
	ton /square inch	kilogram/ square millimetre	1.5749	0.635

Description	British unit	Metric unit	Conversion factors (×)	
	FPS System	CGS System	FPS to CGS	CGS to FPS
	ton /square feet	kilogram/square centimetre	1.0937	0.9144
	ton /square feet	kilograms/square metre	157.493	0.006349
	pound /square inch	metre of water	0.7031	1.4223
	atmosphere	kilogram/square centimetre	1.0332	0.9678
	atmosphere	metre of water	10.342	0.0967
Work & energy	foot poundal	gram centimetres	429.474	0.002328
	foot pound	ergs	13564925	0.00000007372
	foot ton	kilogram metres	309.685	0.003229
	horse power	force de cheval	1.01385	0.9863
Moment of inertia	inch4	centimetre4	41.6263	0.024
	foot4	metre4	0.0086	115.862
Section modulus	inch²	centimetre²	16.3871	0.061
	foot ²	metre²	0.0283	35.3147
Bending moment	inch pound	kilogram centimetre	1.1521	0.8680
	foot pound	kilogram metre	0.1383	7.2330
	inch ton	kilogram centimetre	25.803	0.0387
	foot ton	tonne metre	0.31	3.2258
Fuel consumption discharge	gallons per mile	litre per kilometre	2.8247	0.354
	cu feet per minute	litre per second	0.472	2.1186
	cu feet per minute	cubic centimetre/second	472	0.00212
	gallon per hour	litre per minute	0.76	13.1985

Lighting calculator

FPS to CGS

Reference	Quantity	Approximate conversion	Correction factor
Linear	10 thousandths of an inch	¼ millimetre	Plus 1.6%
	4 inches	10 centimetres	Plus 1.6%
	11 yards	10 metres	Plus 1.6%
Square	3 square inches	20 square centimetres	Minus 3.2%
	1 square feet	1000 square centimetres	Minus 7.1%
	6 square yards	5 square metres	Plus 0.3%
Cubic/ capacity	2 gallons	9 litres	Plus 1%
	6 cubic inches	100 cubic centimetres	Minus 1.7%

Reference	Quantity	Approximate conversion	Correction factor
	4 cubic yards	3 Cubic metres	Plus 1.9%
Pressure	10 pounds per square inch	20 Inches of Mercury	Plus 1.8%
	10 pounds per square inch	700 Grams/sq cm	Plus 0.4%
Weight	1 ton	1000 kilograms	Plus 1.6%
	1 hundredweight	50 kilograms	Plus 1.6%
Heat	11 therm (100000 BTU)	30 kilowatt hours	Minus 2.4%
	4 BTU	1 kilogram calorie	Plus 0.8%
Thermal conductivity	3000 BTU/square feet/Hour/°F /Inch	1 gram/square cm /sec/°C/cm	Plus 3.3%

Miscellaneous conversion factors

Description	Multiply by	To convert	To
Pressure	0.016	pounds /square foot	foot of water
	62.4	foot of water	pounds per square feet
	33.93	atmosphere	foot of water
	0.0295	foot of water	atmosphere
	0.0681	pounds /square inch	atmosphere
	14.696	atmosphere	pounds /square inch
	29.92	atmosphere	inch of mercury
	0.334	inch of mercury	atmosphere
	0.4335	pounds /square inch	foot of water
	2.3068	foot of water	pounds /square inch
Note: Absolute pressure = 29.92 inches (760 mm) of mercury Pressure of atmosphere = 14.7 pounds /square inch or 1.03341 kilogram /square centimetre.			
Lineal	0.8690	mile	nautical mile
	1.1508	nautical mile	mile
Capacity	6.24	cubic feet	gallons
	0.1605	gallons	cubic feet
	10	gallon of water	pounds of water
	0.10	pounds of water	gallon of water
Lineal velocity	0.6818	foot per second	miles per hour
	1.467	miles per hour	foot per second
	0.014	foot per minute	mile per hour
	88	mile per hour	foot per minute
	0.8684	miles per hour	knot
	1.1515	knot	miles per hour

Exact conversions

Inch & its equivalent

1 inch	= 3 Barley corns	= 25.4 millimetres
	= 72 points	= 25.4 millimetres
	= 12 lines	= 25.4 millimetres
	= 1000 mils	= 25.4 millimetres
2½ inches	= 1 nail	= 63.5 millimetres
3 inches	= 1 palm	= 75.2 millimetres
4 inches	= 1 hand	= 101.6 millimetres
7.92 inches	= 1 link	= 201.168 millimetres
9 inches	= 1 span	= 228.60 millimetres
12 inches	= 1 foot	= 304.80 millimetres
18 inches	= 1 cubit	= 457.20 millimetres
36 inches	= 1 yard	= 914.40 millimetres
45 inches	= 1 ell	= 1143 millimetres
3937 inches		= 99999.8 millilitres

Fraction of an inch

1 inch when divided in 8 equal parts (8 सूत)			**1 inch when divided in 10 equal parts (10 सूत)**		
Inch	equivalent सूत	equivalent millimetre	Inch	equivalent सूत	equivalent millimetre
1/8 (0.125)	1 सूत	3.175 millimetres	1/10	1 सूत	2.54 millimetres
¼ (0.25)	2 सूत	6.35 millimetres	1/5	2 सूत	5.08 millimetres
3/8 (0.375)	3 सूत	9.525 millimetres	3/10	3 सूत	7.62 millimetres
			2/5	4 सूत	10.16 millimetres
½ (0.5)	4 सूत	12.7 millimetres	½	5 सूत	12.7 millimetres
5/8 (0.625)	5 सूत	15.875 millimetres	3/5	6 सूत	15.24 millimetres
¾ (0.75)	6 सूत	19.05 millimetres	7/10	7 सूत	17.78 millimetres
7/8	7 सूत	22.225 millimetres	4/5	8 सूत	20.32 millimetres
			9/10	9 सूत	22.86 millimetres
1	8 सूत	25.4 millimetres	1	10 सूत	25.4 millimetres

Length

1 inch	=25.4 millimetres	0.03937 inch =	0.001 metre	millimetre
1 foot	=0.3048 metres	0.3937 inch =	0.01 metre	centimetre
1 yard	=0.9144 metres	3.937 inches =	0.01 metre	decimetre
1 furlong	=201.168 metres	39.37 inches =	1 metre	metre
1 mile	=1.609344 kilometre	393.7 inches =	10 metres	decametre
1 millimetre	=0.03937 inch	328 feet 1 inch =	100 metres	hectometre
1 metre	=3.28084 feet	0.62137 mile =	1000 metres	kilometre
1 metre	=1.03961 yards	6.2137 miles =	10,000 metres	myria-metre
1 Kilometre	=0.62137 Mile			

International foot

1 international foot	= 0.999998 survey foot (exactly)	= 30.48 centimetres (exactly)
1 international foot	= 12 × 0.0254 meter (exactly)	
1 survey foot	= 1200/3937 meter (exactly)	

Area

1-centiare=1,550 square inches=1 square metre
1-are =119.6 square yards =100 square metres = 1/100 of a hectare
1-hectare =2.471 acres =10,000 square metres

And

1 square inch	=6.4516 square centimetres	1 square centimetre	=0.155 square inch
1 square foot	=0.092903 square metre	1 square metre	=10.7639 square feet
1 square yard	=0.83613 square metre	1 square metre	=1.19599 square yards
1 acre	=0.404686 hectares	1 hectare	=2.4711 acres
1 square mile	=2.59 square kilometre	1 square kilometre	=0.3861 square mile
1 square mile	=640 acres		

Volumes

1 cubic inch	= 16.3871 cubic centimetres
1 cubic foot	= 0.028317 cubic metre
1 cubic yard	= 0.76455 cubic metre
1 cubic centimetre	= 0.061024 cubic inch
1 cubic metre	= 35.315 cubic feet
1 cubic metre	= 1.30795 cubic yards

Capacity

1 Imperial Gallon = 4.54596 litres
1 litre = 0.219976 Imperial gallon
30 minims = 2 millilitres
15 minims = 1 millilitre
10 minims = 0.6 millilitre

Capacity- United States measure

0.061 cubic inch = 0.27 fluid dram
0.6102 cubic inch = 0.3328 fluid ounce = 0.10 decilitre
6.1025 cubic inches = 0.845 gill = 1 litre
0.9081 quart = 1.0567 liquid quart = 0.86 litre
1.135 peck = 2.6718 gallons = 10.12 litres
2.828 bushels = 26.418 gallons = 100.02 US litres

Fluid capacity

Fluid measure	UK	US
1 pint	0.568262 cubic metre	0.473176 cubic metre
1 fluid ounce	28.413062 cubic decimetre	29.57353 cubic decimetre
1 fluid drachma	3.551634 cubic decimetre	

Weights

1 ounce = 28.3495 grams
1 pound = 0.4535924 kilogram
1 cwt = 0.50802 quintals
1 ton = 1.01605 metric tonne
1 tola = 11.6638 grams
1 seer = 0.9331 kilogram
1 maund = 0.37324 quintal
1 megaton = 1 000 000 tons

1 gram = 0.035274 ounce
1 kilogram = 2.2042 pounds
1 quintal = 1.9684 cwt
1 metric tonne = 0.9842 ton
1 gram = 0.085735 tola
1 kilogram = 1.07169 seer
1 quintal = 2.67923 maund

175 pounds troy = 144 pounds avoirdupois
Pounds avoirdupois × 1.2153 = pounds troy
Pounds avoirdupois × 1.2153 = pounds apothecary
Apothecary × 0.8228 = avoirdupois
Pounds troy × 0.8228 = pounds avoirdupois

Miscellaneous 1

Avoirdupois	Weight of what quantity of water at max density	Number of grams	Name
0.0154 grain	1 cubic millilitre	0.001	milligram
0.1543 grain	10 cubic millilitres	0.01	centigram
1.5432 grains	0.1 cubic centimetre	0.1	decigram
15.4321 grains	1 cubic centimetre	1	gram

Avoirdupois	**Weight of what quantity of water at max density**	**Number of grams**	**Name**
0.3427 ounce	10 cubic centimetres	10	decagram
3.5274 ounces	1 decilitre	100	hectogram
2.2046 pounds	1 litre	1 000	kilogram or kilo
22.045 pounds	1 dekalitre	10 000	myriad gram
220.46 pounds	1 hectolitre	100 000	quintal
2204.6 pounds	1 cubic metre	1 000 000	metric ton

Miscellaneous 2

1 gallon in wine, dry measure	= 277.463 cu in = 0.16057 cu feet =10 lb of distilled water
1 bushel	= 2219.7 cubic inches = 1.285 cubic foot
1 US bushel	= 2150.4 cubic inches = 0.9688 bushel
Bushels	= Cubic feet × 0.778 = Cubic inches × 0.00045
gallons imperial	= Cubic feet × 6.2355 = Cubic inches × 0.003604=5 Seers
US gallon	= 231 cubic inches = 0.1337 cubic feet = 3.8 litres
1.2 × US gallons	= Gallons imperial
0.264 × US gallon	= 1 litre
7.476 × US gallon	= 1 cubic foot of water

Metric to non metric measures: Equivalents

Category	**Metric**		**Approx. Non-metric equivalents**
Length	10 millimetres	= 1 centimetre	= 0.394 inch
	100 centimetres	= 1 metre	= 39.40 inches/1.094 yards
	1000 metres	= 1 kilometre	= 0.6214 mile
Area	100 Square metres	= 1 Are	= 0.025 acre
	100 Ares	= 1 hectare	= 2.471 acres
	100 hectares	= 1 square kilometre	= 0.386 square mile
Weight	1000 milligram	= 1 gram	= 15.43 grains
	1000 gram	= 1 kilogram	= 2.205 pounds
	1000 kilogram	= 1 tonne	= 19.688 cwt
Capacity	10 millilitres	= 1 centilitre	= 0.018 pint (0.021 US pint)
	100 centilitre	= 1 litre	= 1.76 pint (2.1 US pint)
	10 litres	= 1 dekalitre	= 2.2 gallons (2.63 US gallons)

Non metric to metric measures: Eequivalents

Category	Non-metric		Approximate metric equivalents
Length	--	1 inch	= 25.4 millimetres
	12 inches	= 1 foot (feet)	= 30.48 centimetres
	3 feet	= 1 yard (yd)	= 0.915 metre
	6 feet	= 1 fathom	= 1.83 metres
	5½ yards	= 1 rod, pole	= 5.0325 metres
	220 yards	= 1 furlong	= 201.17 metres
	8 furlongs	= 1 mile	= 1.609 kilometre
	1760 yards	= 1 mile	= 1.609 kilometre
Area	---	= 1 square in	= 6.542 square cm
	144 square inches	= 1 square feet	= 909.03 square centimetres
	9 square feet	= 1 square yard	= 0.83613 square metre
	4840 square yards	= 1 acre	= 0.405 hectare
	640 acres	= 1 square mile	= 259 hectares or 2.59 sq km
Weight	437 grains	= 1 ounce	= 28.35 grams
	16 ounces	= 1 pound	= 0.454 kilogram
	14 pounds	= 1 stone	= 6.356 kilogram
	8 stone	= 1 hundredweight	= 50.8 kilogram
	20 cwt	= 1 ton	= 1016.4 kilogram
British capacity	20 fluid ounce	= 1 pint (pt)	= 0.568 litre
	2 pints	= 1 quart (qt)	= 1.136 litres
	8 pints	= 1 gallon (gal)	= 4.546 litres
American capacity	16 US fluid ounce	= 1 US pint	= 0.473 litre
	2 US pint	= 1 US quart	= 0.946 litre
	8 US pint	= 1 US gallon	= 3.7854 litres

Useful unit equivalents

One acre-foot = 1 acre of water 1 foot deep = 4840×9×1 = 43,560 cubic feet
One acre-foot = 1233.482 cubic metres = 0.123 348 hectare metre
Acre inch = 1/12 acre foot = 3630 cu ft = 22628.575 imperial gallons = 102.7902 cu m
One Cusec-day= 1.98 Acre-feet = 1 × 24 × 60 × 60 = 86,400 cubic feet
Hectare metre= one metre depth on one hectare area = 10,000 cubic metres
Stadium (plural stadia) (Greek) = 606 feet 6 inches = 188 metres
Stadium (plural stadia) (Rome) = 583 to 631 feet = 177.6 to 192.3 metres
Acres × 0.0015625 = sq mile;
Sq yd × 0.000000323 = sq mile;
1 chain wide = 8 acres per mile

Cusec

Cusec is a measure of flow rate and is informal shorthand for cubic feet per second (28.317 litres per second). In the United States it is generally applied to water flow, particularly in rivers. Other informal synonyms are cfs and second-feet.

- 1 ft^3s^{-1} = 0.028316847m^3s^{-1}
- 1 ft^3s^{-1} = 1 cusec
- 1 ft^3s^{-1} = 28.316847 litre s^{-1}
- 1 cubic foot per minute = 1 cufm
- 1 cufm = 1.699m^3min^{-1}
- 1 cufm = 1699 litres min^{-1}
- 1 gallon per minute = 0.07577 litre s^{-1}
- 1 gallon per minute = 7.577x$10^{-5}m^3s^{-1}$

(Note these are UK not US gallons : 1 UK gallon = 1.201 US gallons)

Useful Formulae

[feet ÷ 3.28] [kilogram per metre ÷ 1000]	metric tonne
[feet (16 ÷ feet)] ÷ 2240	metric tonne
[feet × pound per feet] ÷ 2240	British ton

Electrical units & equivalents

Unit	Equal to
Gram-centimetre	Foot-pound × 13825.45
Foot-poundal	Foot-pound × 32.1912
BTU	Foot-pound × 0.001285
Kilogram-metres/second	Foot-pound/second × 0.1382545
Gram-centimetre	Ergs × 0.001019
Foot-pound	Ergs × 7.373 × 10^4
Joules	Ergs × 10^{-7}
Gram-centimetre	Joules × 10191
Kilogram-metres	Joules × 0.10191
Foot-pound	Joules × 0.73719
Foot-poundal	Joules × 23.731
Gramme calorie	Joules × 0.2388
BTU	Joules × 0.000948
Horse power (British)	Joules/second × 0.0013403
Force-de-cheval	Joules/second × 0.0013589
Horse Power (British)	Watts × 0.0013403
Force-de-cheval	Watts × 0.0013589
feet-pounds/second	Watts × 0.73719
Kilogram-metres/second	Watts × 0.10191
(Gramme) calories/second	Watts × 0.2388

Unit	Equal to
BTU per second	Watts × 0.000948
Horse power hour	Watt hours × 0.0013403
Foot-pound	Watt hours × 4653.8
BTU	Watt hours × 3.41116
Gramme calorie	Watt hours × 859.68
Joules	Watt hours × 3600
Ergs	Watt hours × 3.6×10^{10}
Kilowatt hour	Watt hours × 0.001
Horse power (British)	K W (Kilowatt) × 1.3403
Foot-pound	Gram-centimetre × 0.00007233
Foot-pound	Foot-poundal × 0.31064
Foot-pound	BTU × 778
Foot-pound/second	Kilogram-metres/second × 7.233
Ergs	Gram-centimetre × 981.17
Ergs	Foot-pound × 13565116.8
Ergs	Joules × 10000000
Joules	Gram-centimetre × 0.00009812
Joules	Kilogram-metres × 9.8117
Joules	Foot-pound × 1.35651
Joules	Foot-poundal × 0.0421387
Joules	Gramme calorie × 4.186
Joules	BTU × 1055.36
Joules per second	Horse power (British) × 746.08
Joules per second	Force-de-cheval × 735.89
Watts	Horse power (British) × 746.08
Watts	Force-de-cheval × 735.89
Watts	Foot-pounds/second × 1.35651
Watts	Kilogram-metres/second × 9.8117
Watts	(Gramme) calories/second × 4.186
Watts	BTU per second × 1055.36
Watt hours	Horse power hour × 746.08
Watt hours	Foot-pound × 0.0003768
Watt hours	BTU × 0.293
Watt hours	Gramme calorie × 0.00116
Watt hours	Joules × 0.000278
Watt hours	Ergs × 2.778×10^{-11}

* Force-de-cheval - Metric horsepower

Poundal - A unit of force equal to the force that imparts an acceleration of 1 foot/sec/sec to a mass of 1 pound; equal to 0.1382 newtons

Units related to Printing &Computer

Byte	A sequence of 8 bits (enough to represent one character of alphanumeric data) processed as a single unit of information (There are 8 bits in a byte.)
megabyte	a unit computer memory equal to 1048576 (i.e. 2^{20}) bytes
Bit	A unit of measurement of information (from binary + digit); the amount of information in a system having two equally probable states
Binary notation	Any notation that uses 2 characters (usually 0 and 1)
Binary + digit	Either 0 or 1 in binary notation
Pixel	Pixel is the smallest element of an image that can be individually processed in a video display system. (Computer science) the smallest discrete component of an image or picture on a CRT screen (usually a coloured dot) The greater the number of pixel per inch the greater the resolution
Bit map	Bit map is a piece of text, a drawing, etc., represented, as on a computer display, by the activation of certain dots in a rectangular matrix of dots.
Point (computer)	1point=0.013888889 inch or 0.3527778 mm
Pica (computer)	1 pica =0.167541535 inch or 4.233333 mm
Point (printer)	A linear unit used to measure the size of type; approximately 1/72 inch
	1point - 0.013837 inch or 0.3514598 mm
Pica em (printer's)	1 pica= a unit of distance used by typesetters and printers(0.1780 inch or 4.5212 mm)
	1 pica = 12 points – about 1/6 inch (4.233333 mm) having 10 characters to the inch
	1 pica= Linear unit (1/6 inch=4.233333 mm) used in printing
em	A linear unit (1/6 inch or 4.233333 mm) used in printing
	The square of any size of type used as the unit of measurement for matter printed in that type size.
em dash	A dash one em long
em quad	A square unit of area or type that is approximately one em on each side
en	A space that is half the width of an em

Relation between units used in Electronics

Quantity	Practical CGS system unit	(Rationalised) MKSA system unit	for 1 MKSA (rationalised) unit equivalent number of		
			Practical CGS unit	e.m.u.*	e.s.u.**
Length	Centimetre	Metre	10^2	10^2	10^2
Mass	Gramme (g)	Kilogramme	10^3	10^3	10^3
Time	Second (t)	Second (t)	1	1	1
Force	Dyne (f)	Newton (f)	10^5	10^5	10^5
Energy, work	Joule	Joule	1	10^7	10^7
Power	Watt	Watt	1	10^7	10^7
Electric charge	Coulomb	Coulomb	1	10^{-1}	3×10^9
Electric potential (e.m.f.)	Volt	Volt	1	10^8	$1/3 \times 10^{-2}$
Current	Ampere	Ampere	1	10^{-1}	3×10^9
Surface charge density	Coulomb/cm^2	Coulomb/m^2	10^{-4}	10^{-5}	3 × 103
Volume charge density	Coulomb/cm^3	Coulomb/m^3	10^{-4}	10^{-7}	3×10^3
Electric field intensity	Volt/cm	Volt/metre	10^{-6}	10^{-7}	$1/3 \times 10^3$
Electric dipole moment	Coulomb/cm	Coulomb/metre	10^2	10	3×10^{11}
Polarization	Coulomb/cm^2	Coulomb/m^2	1	10^{-5}	3×10^5
Electric displacement	—	Coulomb/m^2	$4 \pi \times 10^{-4}$	$4 \pi \times 10^{-5}$	$12 \pi \times 10^9$
Displacement Flux	—	Coulomb	4π	$4 \pi \times 10^{-1}$	
Surface current density	Ampere/cm^2	Ampere/m^2	10^{-2}	10^{-3}	3×10^7
Resistance	Ohm	Ohm	1	10^9	$1/9 \times 10^{-9}$
Conductance	Mho	Mho	1	10^{-9}	9×10^{11}
Resistivity	Ohm/cm	Ohm/m	10^2	10^{11}	$1 \div 9 \times 10^{-9}$
Conductivity	Mho/cm	Mho/m	10^{-2}	10^{-11}	9×10^9
Capacitance	Farad	Farad	1	10^{-9}	9×10^{11}
Permittivity	—	Farad/m	$\frac{1}{4} \pi \times 10^{-9}$	$4 \pi \times 10^{-11}$	$36 \pi \times 10^9$
Magnetic charge	—	Weber	$\frac{1}{4} \pi\ 10^8$	$\frac{1}{4} \pi\ 10^8$	$1/12 \times \pi\ 10^{-2}$
Magnetic field intensity	Amp-turn/ cm	Ampere-turn/m	$4 \pi\ 10^{-3}$	$4 \pi\ 10^{-3}$	$12 \pi \times 10^7$
Magnetic induction	Gauss	Weber/m^2	10^4	10^4	$1/3 \times 10^{-6}$
Permeability	Gauss/oersted	henry/m	$10^7 \div 4 \pi$	$10^7 \div 4 \pi$	$1/36 \times \pi \times 10^{-13}$
Magnetic Flux	Maxwell (line)	Weber	10^8	10^8	$1/3 \times 10^{-2}$
Magnetic-potential (mmf)	Gilbert	Ampere-turn	$4 \pi \times 10^{-1}$	$4 \pi \times 10^{-1}$	$12 \pi \times 10^9$
Reluctance	Gilbert/Maxwell	Amp-turn/Weber	$4 \pi \times 10^{-9}$	$4 \pi \times 10^{-9}$	$36 \pi \times 10^{11}$
Inductance	Henry	Henry	1	10^9	$1/9 \times 10^{-11}$

*__e.m.u__. - Electromagnetic unit (Any of various systems of units for measuring electricity and magnetism)

e.s.u. - Electro static unit (Any of various units of electricity based on forces of interaction between electric charges)

Oersted: centimetre-gram-second unit of magnetic intensity i.e. the magnetic field strength 1 cm from a unit magnetic pole

Farad - The capacitance of a capacitor that has an equal and opposite charge of 1 coulomb on each plate and a voltage difference of 1 volt between the plates

Temperature

Terminology

absolute zero	(Cryogenics) the lowest temperature theoretically attainable (at which the kinetic energy of atoms and molecules is minimal); 0 Kelvin or -273.15 centigrade or -459.67 Fahrenheit
Boiling point	The temperature at which a liquid boils at sea level
Celsius	Temperature measurement on the Celsius scale (where water freezes at zero degrees and boils at 100 degrees; unit divisions are equal to the kelvin, with zero kelvin being -273.15 C)
Centigrade	Of or relating to a temperature scale on which the freezing point of water is 0 degrees and the boiling point of water is 100 degrees
Cryogenics	The branch of physics that studies the phenomena that occur at very low temperatures
Fahrenheit	Of or relating to a temperature scale proposed by the inventor of the mercury thermometer. (where water freezes at 32 degrees Fahrenheit and boils at 212 degrees Fahrenheit under normal conditions)
Freezing point	The temperature below which a liquid turns into a solid
Kelvin	The basic unit of thermodynamic temperature adopted under the Système International d'Unités. A unit of temperature equal to the Celsius degree in the Kelvin scale 0 ° fixed as absolute zero (-273.15° C).
Melting point	The temperature below which a liquid turns into a solid
Pyrometers	Pyrometers are instruments used for measuring high temperatures using emitted radiation of about 900 K. it uses the radiation emitted by a hot body as a basis for measurement.
Reaumur	A temperature scale proposed by the inventor of the Alcohol thermometer (where water freezes at 0 degrees Reaumur and boils at 80 degrees Reaumur under normal conditions)
Temperature	The temperature is degree of hotness or coldness of a body or environment (corresponding to its molecular activity)
Temperature gradient	Change in temperature as a function of distance (especially altitude)

Thermometer Thermometer is measuring instrument for measuring temperature
Thermopile A kind of thermometer for measuring heat radiation; consists of several thermocouple junctions in series

- ⇨ The boiling and freezing points are those of water at mean sea level, atmospheric pressure.
- ⇨ Freezing point, or 32° Fahrenheit = Zero in Centigrade (also Celsius) or Reaumur.
- ⇨ Boiling, or 212° Fahrenheit (F) = 100° Centigrade (C), or 80° Reaumur (R)
- ⇨ The number of degrees between freezing point and boiling point of water is 212 - 32 = 180°, on Fahrenheit scale, 100° on the Centigrade scale, and 80° on the Reaumur scale. The magnitude of the degrees Fahrenheit relative to degrees centigrade is thus as 5 to 9

Thermometer

Alcohol thermometer

This thermometer consist of a glass capillary tube marked with degrees Celsius or Fahrenheit and contains alcohol which rises or falls as it expands or contracts with changes in temperature.

Mercury thermometer

Thermometer consisting of mercury contained in a bulb at the bottom of a graduated sealed glass capillary tube marked in degrees Celsius or Fahrenheit; mercury expands with a rise in temperature causing a thin thread of mercury to rise in the tube

Reaumur thermometer

A thermometer used in a number of European countries. Zero degree is given as the melting point of the ice and 80 degrees as the boiling point of water.

Clinical thermometer

The clinical thermometer is a special liquid-in-glass thermometer. This thermometer designed specially to measure human body temperature and graduated to cover a range a few degrees on either side of the normal body temperature. Normal body temperature is 30° C (98.4°F).

Recording thermometer

A thermometer that makes a permanent record of variations in temperature, usually by an inked line traced automatically on a paper disk or roll.

Thermometer test

To test a mercurial thermometer, invert it. The mercury should strike the end with a click, showing the vacuum is perfect. Detach a piece of mercury by

a jerk, this piece should read the same length at all parts of the tube (this verifies the parallelism of the tube). The thermometer in melting ice should read 32° Fahrenheit, in steam 212° Fahrenheit.

All thermometers have small errors. Where great accuracy is required, they should be compared with standard thermometer, for every 10°, errors noted and added to or subtracted f from the observations.

Decrease of temperature with altitude

The temperature decreases at different altitudes.

Temperature decreases 1 degree centigrade per 160 metres at higher altitude of the environment.

Every degree centigrade corresponds with from 150 to 260 metres, or an average of about 200 metres.

Or, every degree Fahrenheit from 273 feet in summer to 474 feet in winter; or an average of 364 feet per degree Fahrenheit.

Increase of temperature below surface of the earth

One degree centigrade for every 31 to 32 metres depth; or, one degree Fahrenheit for every 57 feet depth, when volcanic disturbance does not affect the temperature,

The mean temperature of any place at sea level should vary approximately as the cosine of the latitude (if there are no disturbing causes). The mean temperature at the equator may be taken as 80 degrees Fahrenheit.

Temperature equivalent

Celsius & Fahrenheit

Celsius	Fahrenheit	Fahrenheit	Celsius
0°	32°	0°	- 17.777778°
10°	50 °	10°	-12.222222°
100°	212°	100°	37.7777778°
200°	392°	200°	93.3333333°
300°	572°	300°	148.88889°
400°	752°	400°	204.4444°
500°	932°	500°	260°

Fahrenheit/Celsius & Kelvin

Celsius	Kelvin	Kelvin	Celsius	Fahrenheit	Kelvin	Kelvin	Fahrenheit
0°	273.15	0°	- 273.15	0°	253.37222	0°	- 459.67
10°	283.15	10°	-263.15	10°	260.92778	10°	- 441.67
50°	323.15	50°	- 223.15	32°	273.15	32°	- 402.07
100°	373.15	100°	- 173.15	100°	310.92778	100°	- 279.67
200°	473.15	200°	- 73.15	200°	366.48333	200°	- 99.76
300°	573.15	300°	26.85	300°	422.O3889	300°	80.33

400°	673.15	400°	126.85	400°	477.59444	400°	260.33
500°	773.15	500°	226.85	500°	33.15	500°	440.33

Conversion factors

Degree Centigrade (C) = 5(F – 32) ÷ 9 = 1.25 × R

Degree Reaumur (R) = 4(F – 32) ÷ 9 = 0.80 × C

Degree Fahrenheit (F) = (9C ÷ 5) + 32 = (9R ÷ 4) + 32 = C + R + 32

C= Temperature Centigrade; R= Temperature Reaumur; F= Temperature Fahrenheit

Determination of temp

By cooling heated iron in water

H = temperature of the heated iron.

T_0 = temperature of the water before cooling the iron in Fahrenheit.

T = temperature of the water after cooling the iron in Fahrenheit.

S = specific heat of the iron (0.13 for cast iron. 0.113 for wrought iron).

W_{iron} = weight of the iron

W_{water} = weight of the water in which iron is cooled

Than

$$H = t + [\{W_{water}(T - T_0)\} \div \{(S \times W_{iron})\}$$

Units of measures – Textile industry

cloth yard	former	37 inches			or 0.93 meter
cloth yard	Standard yard				0.91 meter
clothier's yard	English ell	20 nails	1.25 yards	45 inches	1.143 meters
nail		1/20 ell	1/16 yard	2.25 inches	5.715 cm
goad			1.5 yards	54 inches	1.3716 meters

Bolt

Bolt - a commercial unit of length or area used to measure finished cloth. One bolt represents a strip of cloth 100 yards (91.44 metres) long, but the width varies according to the fabric

Cotton bolt	100 yards ×42 inches	= 116.667 sq yd	=97.566 sq m
Wool bolt	100 yards × 60 inches	=166.667 sq yd	=139.355 sq m

1 bolt of cloth = 40 yards

Sound

Velocity of sound in various media

Media	Feet Per second	Metre Per second
Air	1086	331
Water	4900	1494

Media	Feet Per second	Metre Per second
Wet sand	825	251
Contorted rock	1090	332
Discontinuous granite	1306	398
Solid granite	1664	507
Iron	17500	5334
Copper	10378	3163
Wood	11000 to 16700	3352 to 5090
Concrete	16404	5000
Distant sounds may be heard on a still day: Human voice = 137 metres (150 yards). Rifle = 4850 metres (5304 yards)		

Speed & Velocity

Speed

Distance travelled per unit time i.e. = Distance ÷ time

Speed equivalent

Mph	20	30	40	50	60	70	80	90	100
Km Ph	32	48	64	80	96	112	128	144	160

Velocity

Distance travelled per unit time

Acceleration

Acceleration is a rate of increase of velocity'

Rate of acceleration

Miles per hour per second × 1.4667 = Feet per second per second
Miles per hour per second × 1.60936 = Kilometres per hour / second
Miles per hour per second × 0.44704 = Metres per second per second
Feet per second per second × 0.68182 = Miles per hour per second
Feet per second per second × 1.09728 = Kilometres per hour / second
Feet per second per second × 0.3048 = Metres per second per second
Kilometres per hour / second × 0.62137 = Miles per hour per second
Kilometres per hour / second × 0.91133 = Feet per second per second
Kilometres per hour / second × 0.2778 = Metres per second per second
Metres per second per second × 2.2369 = Miles per hour per second
Metres per second per second × 3.2808 = Feet per second per second
Metres per second per second × 3.6 = Kilometres per hour per second

British & Metric Equivalent (Speed)

British units	Metric units
1 Foot per hour	=84.6667 millimetres per second
1 Foot per hour	=304.80 millimetres per hour
1 foot per minute	=5.08 millimetres per second
1 foot per minute	=304.80 millimetres per minute
1 foot per second	=304.80 millimetres per second
1 inch per minute	=25.40 millimetres per minute
1 inch per second	=25.40 millimetres per second
1 knot international	=1.852 kilometre per hour
1 knot international	=0.514444 metre per second
1 knot UK	=1.85318 kilometre per hour
1 mile per hour	=0.44704 metre per second
1 mile per hour	=1.609344 kilometre per hour
1 mile per minute	=26.8224 metres per second

Paper Sizes

Paper is usually sold by the ream in sheets of standard sizes. A ream of paper usually contains 480 sheets, but reams of drawing paper and handmade paper contain 472 sheets. Book paper and newsprint for flat-plate printing are sold in reams of 500 sheets and in perfect reams of 516 sheets. The most common book-paper size is octavo (112 by 168 cm / 44 by 66 inches). Newsprint for rotary-press printing comes in rolls of varying sizes; a typical roll of newsprint, as used by large metropolitan newspapers, is about 168 centimetres (66 inches) wide, 7925 metres (26,000 feet) long, and weighs about 725 kilogram.

Book sizes

Description	Size		Particulars
	Inch	cm	
Duodecimo	5 × 7½	13 ×19	Also called twelvemo a book size determined by printing on sheets folded to form 12 leaves or 24 pages. Symbol: 12 mo, 12°
Octavo	6 × 9	16 × 23	Book size determined by printing on sheets folded to form 8 leaves or 16 pages. Symbol: 8vo, 8°
Quarto	9½ × 12	24 × 30	Book size, determined by folding printed sheets twice to form four leaves or eight pages. Symbol: 4 to, 4°
Sixteenmo	4 × 6	10 × 15	Also called sextodecimo a book size determined by printing on sheets folded to form 16 leaves or 32 pages. Symbol: 16mo, 16°

Writing & Poster paper

Writing paper measures

24 sheets = 1 quire
20 quires = 1 ream
480 sheets= 1 ream
10 reams = 1 gattha

Writing paper measures

Particulars	Size in inches
Large Post	21 × 16½
Copy (Draught)	20 × 16
Demy	20 × 15½
Post	19 × 15¼
Pinched Post	18½ × 14¾
Foolscap	17 × 13½
Brief	16½ × 13¼
Pott	15 × 12½

Writing paper sizes

Particulars	Size in inches
Emperor	72 × 48
Antiquarian	53 × 31
Grand Eagle	42 × 28¾
Double Elephant	40 × 27
Colombier	34½ × 23½
Atlas	34 × 26
Double Large Post	33 × 21
Double Demy	31 × 20
Double Post	30½ × 19
Imperial	30 × 22
Elephant	28 × 23
Super Royal	27 × 19
Double Foolscap	26½ × 16½
Cartridge	26 × 21
Royal	24 × 19
Medium	22 × 17½

Poster & printing paper measure

Particulars	Size in inches
516 sheets	1 ream
2 reams	1 bundle
5 bundles	1 bale

Poster & printing paper sizes

Particulars	Size in inches
Double Quad Crown	60 × 40
Quad Demy	45 × 35
Quad Crown	40 × 30
Double Demy	35 × 22½
Quad Foolscap	34 × 27
Double Large Post	33 × 21
Double Post	31½ × 19½
Imperial	30 × 22
Double Crown	30 × 20
Elephant	28 × 23
Super Royal	27½ × 20½
Double Foolscap	27 × 17
Royal	25 × 20
Medium	23 × 18
Demy	22½ × 17½
Music Demy	20 × 15½

Poster & Printing paper measure

Particulars	Size in inches
Crown	20 × 15
Post	19¼ × 15½
Foolscap	17 × 13½

International Paper Sizes

A Series		B & C Series	
Size	**Millimetres**	**Size**	**Millimetres**
4 A 0	1682 × 2378	C3	324 × 458
2 A 0	1189 × 1682	B4	250 × 353
A 0	841 × 1189	C4	229 × 324
A 1	594 × 841	B5	176 × 250
A 2	420 × 594	C5	162 × 229
A 3	297 × 420	B6 / C4	125 × 324
A 4	210 × 297	B 6	125 × 176
A 5	148 × 210	C 6	114 × 162
A 6	105 × 148	D L	110 × 220
A 7	74 × 105	C 7/6	81 × 162
A 8	52 × 74	C 7	81 × 114
A 9	37 × 52		
A 10	26 × 37		
A 11	18 × 26		
A 12	13 × 18		

INDIAN UNITS OF MEASUREMENTS

History of measurement systems in India

One of the most ancient texts of India, Manusmriti, describes among the duties of the king: The king should examine the weights and balances every six months to ensure true measurements and to mark them with the royal stamp. -- Manusmriti, 8th Chapter, Shloka 403.

In the Harappan era, which is nearly 5000 years old, one finds excellent examples of town planning and architecture. The sizes of the bricks were the same all over the region. In the time of Chandragupta Maurya, some 2400 years ago, there was a well - defined system of weights and measures. The government of that time ensured that everybody used the same system. In the Indian medical system, Ayurveda, the units of mass and volume were well defined.

Harappan period (हड़प्पा काल)

In the Harappan era, which is nearly 5000 years old, one finds excellent examples of town planning and architecture. The length, breadth, and width of the bricks used in this era were in the ratio 4:2:1. In the modern system, this is known as the English Bond system. The sizes of the bricks were the same all over the region.

Mauryan period

In the time of Chandragupts Maurya some 2400 years ago, there was a well - defined system of weights and measures. The government of that time ensured that everybody used the same system.

According to this system, the smallest unit of length was Parmanu. The different units of measurements were defined as follows:

- 8 Parmanu = 1 Rajahkan (dust particle coming from the wheel of a chariot)
- 8 Rajahkan = 1 Liksha (egg of lice)
- 8 Liksha = 1 Yookamadhya
- 8 Yookamadhya = 1 Yavamadhya
- 8 Yavamadhya = 1 Angula
- 8 Angula = 1 Dhanurmushti

The measurement system during the time of the Mughal emperor, Akbar, the gaz was the measure of length. The gaz was widely used until the introduction of the metric system in India in 1956. During the British period, efforts were made to achieve uniformity in weights and measures.

A compromise was reached in the system of measurements, which continued till India's independence in 1947. After independence in 1947, it was realised that for fast industrial growth of the country, it would be necessary to establish a modern measurement system in the country.

The Lok-Sabha in April 1955 resolved:-'This house is of the opinion that the Government of India should take necessary steps to introduce uniform weights and measures throughout the country based on metric system'.

Old Indian Measures

महाभारत कालीन सैन्य पद्धति

एक अक्षोनी या अक्षोहिरणी एक पूर्ण चतुरंगिणी सेना होती है। जिसमें होने हैं:-
१,०९,३५०पैदल, ६५,६१० घोड़े,

२१,८७० हाथी, २१,८७० रथ। कुल सैन्य संख्या दो लाख अठ्ठारह हजार सात सौ (२१८७००)

Old Indian money value

Pie पाई	Paisa पैसा	Anna आना	Rupee रूपया	Equivalent to current paise	Remarks
1	1/3	1/12	1/384	—	धेला = एक पैसा; अधेला = आधा पैसा
3	1	1/4	1/64	1.5	अधन्ना = दो पैसा, इकन्नी = चार पैसा
12	4	1	1/16	6	दुवन्नी =दो आना, चवन्नी = चार आना, अठन्नी = आठ आना
192	64	16	1	100	Symbol of Rupee - ₹

टका = एक रूपया, टङ्कण = silver coin a rupee, कर्ष = an old coin, पण = ancient copper coin

भारतीय रुपये पैसों का बही खातों में लिखने का तरीका

एक रुपया =		बारह आना =		आठ आना =		चार आना =	
तीन आना =		दो आना =		एक आना =		तीन पैसा =	
दो पैसा =		एक पैसा =		दो पाई =		एक पाई =	
यथा तीन रुपया साढ़े छ: आना एक पाई →							

Indian tailor's measures

बित्ता या बलिश्त	गिरह	इंच	गज़	Metric equivalent
¼	१	२¼	०.०६२५	57.15 millimetres
१	४	९	¼	228.36 millimetres
४	१६	३६	१	914.40 millimetres

North Indian

Length

जौं	इँच	अंगुल	फुट	बालिश्त या बित्ता	गज़	मील	कोस	CGS unit
3	¾	1						19.05 millimetres
4	1		1/12					25.4 millimetres
36	9	12	3/4	1	¼			228.6 millimetres
48	12	16	1	1-1/3	1/3			305 millimetres
144	36	48	3	4	1			914.4 millimetres
					1760	1	½	1.61 kilometre

The Kos varies from one to two miles in North India; in Punjab, it is generally 2 miles.
जोजन = a space of 8 miles. The English yard is frequently called a gaz (**गज़**) in India

Mass/Weight

खण्डी	मन	पसेरी	सेर	पौंत्र	छटाक	तोला	माशा	रत्ती	चावल	खसखस	CGS	FPS
1	20	160	800								7.442 qtl	1640.68 pound
	1	8	40								37.209 kg	82.03 pound
		1	5	20	80	400	4800				4.651 kg	10.25 pound
			1	4	16	80	960				933.1 gm	2.06 pound
				1	4	20	240				233 gm	8.22 ounce
					1	5	60	480			58 gm	2.05 ounce
						1	12	96	768		11.63 gm	0.41 ounce
							1	8	64	512	0.9692 gm	0.0342 ounce
								1	8	64	0.122 gm	0.0043 ounce
									1	8	0.015 gm	0.0005 ounce
			1.072	4.292	17.24	85.982	969.2	8000	64000	512000	1 kilogram	2.20 pound

१ Tola =180 grain. १ maund = 100 pounds troy (exact) or 82.6 pound avoirdupois.
टंक = 4 माशा, कर्ष = 16 माशा ; १ औंस = १/२ छटांक(लगभग); १ पौंड = १/२ सेर (लगभग)

Area measures

Gaz	Baans	Bigha	English	Metric
गज़	बाँस	बीघा	—	—
1	0.111111	0.00028	0.84028 Sq Yd	0.70 square metre
9	1	0.0025	7.5625 Sq Yd	6.323 square metres
3025	400	1	0.624 acres	0.253 hectare

Capacity

Seer	Pali	Maund	Gallons	Litres
सेर	पाली	मन	गैलन	लीटर
1	1/5	1/40	0. 245	1.1137
5	1	1/8	1.256	5.7098
40	8	1	9.81	44.5963

1 quart = ३ पॉव

1 gallon = ३ सेर १० छटांक (लगभग)

Madras (Chennai)

Weight

Tola	Pollam	Vis	Maund	Candy	Pounds	Kilograms	Remarks
1	0.333	0.00833	0.001042	0.0000521	0.0257	0.01167	* These can be frequently assumed at 25 and 500 pounds respectively.
3	1	0.025	0.003125	0.0001563	0.07714	0.03502	
120	40	1	0.125	0.00625	3.0857	1.4009	
960	320	8	1	0.05	24.686*	11.2074	
19200	6400	160	20	1	493.714*	224.1462	
85.54	28.553	0.71				1	
855.4	285.53	7.1				10	

Length

Span	Cubit	Kos	FPS	Metric
1	0.4444	0.000556	8 inches	203.4 millimetres
2.25	1	0.000125	18 inches	457.2 millimetres
18000	8000	1	2.27 miles	3.6524 kilometre
4928	2190	0.2738	0.6125 mile	1 kilometre

Area measure

Kol	Guni	Kani	FPS	Metric
½	0.2083		12 square feet	1.1148 square metres
1	0.4167	0.0004167	24 square feet	2.2296 square metres
24	1	0.010	576 square feet	53.5104 square metres
2400	100	1	1.32 acre	0.5346 hectare
1818	75.75	0.7575	1 acre	0.4047 hectare

Capacity

Olak	Padi	Mercal	Para	Gus	English	Metric
1	0.08	0.01	0.002	0.000025	8 cubic inches	131.0968 cubic centimetres
12.5	1	0.125	0.025	0.0003175	100 cubic inches	1638.71 cubic centimetres
100	8	1	0.2	0.0025	800 cubic inches	13109.68 cubic centimetres
500	40	5	1	0.0125	4000 cubic inches	65548.4 cubic centimetres
40000	3200	400	80	1	185.2 cubic feet	5.243 cubic metres

Bombay (Mumbai)

Length

Tasu	Haath	Gaz	Inches	Millimetres
1	0.625	0.04167	1.125	28.575
16	1	0.6667	18	457.2
24	1.05	1	27	685.8
35	1.56	1.458	39.37	1000

Area measure

Kati	Pand	Bigha	FPS	Metric
1	0.05	0.0025	10 square yards	8.3613 square metres
20	1	0.05	200 square yards	167.226 square metres
400	20	1	0.825 acre	0.334125 hectare
1.20	0.06			10 square metres

Weight

1 Seer = 0.7 Pound = 0.3178 kilogram

1 Maund= 28 Pounds = 12.712 kilograms

1 Candy = 5 Hundredweight= 2.54 quintals

Capacity

Seer	Pali	Para	Candy	Cubic inch	Gallons	Litres
1	0.25	0.015625	0.00195	49	0.18	0.8183
4	1	0.0625	0.00781	197	0.71	3.2277
64	160	1	0.125	3145	11.37	51.6880
512	128	8	1	25160	90.74	412.5040
12.39	3.10	0.194		609.88	2.20	10

Indian Land Measure

उत्तर प्रदेश की भूमि नापने की विधि

ख़सरा: पटवारी की बही जिसमें खेतों का नम्बर और उनका विवरण होता है। या हिसाब किताब का कच्चा चिट्ठा होता है

दाख़िल ख़ारिज: किसी सरकारी काग़ज पर से किसी जायदाद के पुराने का नाम काट कर उसके वारिस का या दूसरे हकदार का नाम लिखना दाख़िल ख़ारिज कहलाता है

पटवारी की नाप

acre = 1-3/5 bigha = 32 biswa = 4840 sq yd = 0.4037 hectare = 4046.84 sq metres
1 bigha = 20 biswa = 5/8 acre = 3025 square yard
1 biswa = 1/20 bigha = 151.25 square yard = 1361.25 square feet
२२ गज़ या ४ गोंन या लाठा = १जरीब या चेन (cubit) ; १ जरीब = १००कड़ी (link)

Conversion factors

1 centi-are = 1 sq meter = 10.76 sq feet
100 centi-are = 1 are = 100 sq meter
100 are = 1 hectare = 100 meter X 100 meter = 10000 sq meter

Uttar Pradesh

१ लाठा = ९९ इंच
२० अनवॉसी =१ कचवॉसी; २० कचवॉसी = १ विस्वॉसी (१ वर्ग लाठा)
२० विस्वॉसी (२० वर्ग लाठा) (५ लाठा × ४ लाठा चौड़ा) = १ विस्वा या १३६१.२५ वर्ग फीट
२० विस्वा = १ बीघा या ३०२५ वर्ग गज़
१ गज़ इलाही =३३ इंच ; ६६ गज़ इलाही = ५५ गज़
१ बीघा = ६० गुणा ६०वर्ग गज़ इलाही = ५५ × ५५ वर्ग गज़ = ३०२५ वर्ग गज़
८ बीघा = ५ एकड़ = ४८४० × ५ = २४२०० वर्ग गज़

Bengal

बंगाल राज्य की भूमि नापने की विधि

१ वर्ग हाथ = १ गण्डा

२० गण्डा = १ छटाँक

१६ छटाँक = १ काठा = ८० वर्ग गज़ (१० गज़ × ८ गज़) या (३० फीट × २४ फीट)

२० काठा = १ बीघा = १६०० वर्ग गज़

३ बीघा ८ छटाँक (३.०२५ बीघा) = १ एकड़

१२१ बीघा = ४० एकड़

१९३६ बीघा = १ वर्ग मील

A Bigha in Bengal is 0.3306 acres (0.13 hectares).

Punjab

पंजाब राज्य की भूमि नापने की विधि

१ करम = ३ हाथ

९ वर्ग कलम = ९ सरसाई =१ मरला

२० मरला = १ कनाल

४ कनाल = १ बीघा या १६२० वर्ग गज़; २बीघा =१ घमा

Madras (Chennai)

मद्रास (चेन्नई) राज्य की भूमि नापने की विधि

१४४ वर्ग इंच = १ वर्ग फुट

२४०० वर्ग फीट = १ मनाई या ग्राउण्ड

२४ मनाई या ग्राउण्ड = १ काणी या ६४०० वर्ग गज़

४८४ काणी = १ वर्ग मील

१२१ काणी = १६० एकड़

Maharashtra

महाराष्ट्रा राज्य की भूमि नापने की विधि

३९.२५ वर्ग हाथ = १ काठी

२० काठी = १ पाण्ड

२० पाण्ड = १ बीघा या ३९२५ वर्ग गज़

६ बीघा = १ रूके

२० रूके = १ चहर

Haryana

Before Bandobust(Settlement)

1 Karam = 57.157" (Haryana)
1 Biswansi = 1 Karam x 1 Karam (Haryana)
20 Biswansi = 1 Biswa (Haryana)
1 Bigha = 20 Biswa (Haryana)
4 Bigha-16 Biswa = 1 Acre (Haryana)
2.47 acre = 1 hectare(CG)

Government Settlement

1 Karam = 57.157" (Haryana)
20 Biswansi = 1 Biswa (Haryana)
1 Bigha = 20 Biswa (Haryana)
4 Bigha = 1 Kila (Haryana)
1 Kila = 40 Karam x 40 Karam (Haryana)

After Bandobust(Settlement)

1 Karam = 66" (Haryana)
1 Sarsaai = 1 Karam x 1 Karam (Haryana)
9 Sarsaai = 1 Marla (Haryana)
20 Marla = 1 Kanal (Haryana)
8 Kanal = 1 Acre (Ghuman) (Haryana)
1 Acre = 36 Karam x 40 Karam (North to South, East to West) (Haryana)
2.5 Acre = 1 Hectare (CG)

Rajasthan

Shahjahani Jarib(165 feet) (Rajasthan)
1 Bigha = 1 Jarib x 1 Jarib
= 165' x 165' = 27225 Square Feet
1 Bigha(Shahjahani Jarib) = 0.253 Hectare
Gantari Jarib(132 feet) (Rajasthan)
1 Bigha = 1 Jarib x 1 Jarib
= 132' x 132' = 17424 Square Feet
1 Bigha(Gantari Jarib) = 0.16 Hectare
1 Bigha = 20 Biswansi (Rajasthan)

Keral & South

2.47105 Acres = 1 Hectare (Kerala)
1 Are = 2.47105 cents (Kerala)
1 Acre = 100 cents (Kerala,Tamil nadu)
1 Cent = 40 Sq metres or 435 Sq feet
1 Acre = 40 Guntas(Andhra Pradesh and Karnataka)
1 Gunta = 100 Sq metres (around 1100 sq feet)
1 Acre = 121 Sq yards
1 Kuncham = 10 cents(Andhra Pradesh)
1 Sq link = 0.0404687 Sq metre (Kerala)

Tripura & Asam

1 hectare = 404.68458 Acre(Tripura)
40 Are = 1 Acre
1 Lessa = 144 Sq feet
1 Katha = 5 Lessa or 720 Sq feet
1 Bigha(Assam) = 4 Katha or 20 Lessa or 2880 Sq feet

Jharkhand

1 Acre = 4046.94 Sq metre (Jharkhand)
1 Dismil = 40.46 Sq metre (Jharkhand)
1 Katha(Jharkhand) = 66.89 Sq metre (Jharkhand)
1 Dur = 10 Sq metre (Jharkhand)

1 Sq metre = 10000 Sq cm (Gujarat)

Indian Time Measures

Ancient Indians devised a detailed terminology for minute intervals of time. Although some experts feel that this terminology had no relevance to everyday life, this indicates the deep inroads the ancient Indians, especially those who devoted to scholar hood, had made in physics and mathematics.

Vedic Indian Time Measure

Kalpa (कल्प)

Kalpa is divided into 14 periods. Now we are seventh of these 14 periods of the present Kalpa. Each of these is divided into 71 Great intervals and each of these divided in 4 yugas or period of time.

One = 4320000000 earthy years (12 million god-years). It is known as one human day of god Brahma, the creator of the universe.

Yuga (युग)

The Yuga contains respectively 4800, 3600, 2400, and 1200 god-years (each god-year being 360 human years). We are now in fourth Yuga of these

yugas, the ‘Kaliyuga’ when the world is full of evil and wickedness. Following are the four god-years:

Satyuga (सत्त युग) = 4800 god-years =4800 × 360 = 1728000 earthy years.
Tretayuga (त्रेता युग) = 3600 god-years = 3600 × 360 = 1296000 earthy year.
Dwaparyuga (द्वापर युग) = 2400 god-years = 2400 × 360 = 864000 earthy years.
Kaliyuga (कलि युग) = 1200 god-years = 1200 × 360 = 432000 earthy years.

Ancient units of time in India

18 nimesas (winks)	= 1 kashta (3.2 seconds)
30 kashtas (काष्ठा)	= 1 kala (कला) (1.6 minutes)
15 kalas (कला)	= 1 nadika or 1 nalika (नालिक)
30 kalas or 2 nadikas (नादिका)	= 1muhurta or kshana (क्षण) (48 minutes)
30 muhurta (मुहूर्त)	= 1 aho-ratra (अहोरात्र) (1 cycle of day and night, 24 hours)

Table-1

त्रुटि या विपल	निमेष	असु या प्राण	पल	यान या प्रहर	मुहूर्त	घटी	दिन या रात	अहोरात्र	सैकण्ड	मिनट	घन्टा
1	2								0.4		
10	20	1							4		
60	120	6	1						24		
150	300	15	2½						60		
3600	7200	360	60			1			1440	24	
7200	14400	720	120		1	2			2880	48	
9000	18000	900	150	1/3	1¼	2½			3600	60	1
27000		2700	450	1	3¾	7½		1/8	10800	180	3
			1800	4	15	30	1	½	43200	720	12
				8	30	60		1	86400	1440	24

एक चँद्र मास = २९ दिन ३१ घटी ५० पलऔर ७ विपल

Table-2

घन्टा	दिन	सप्ताह	पक्ष	माह	ऋतु	अयन	वर्ष	युग
1	1/24	1/180	1/360	1/720			1/8640	
3	1/8	1/56	1/120	1/240			1/2880	
24	1	1/7	1/15	1/30			1/360	
168	7	1	7/15	7/30			7/360	
360	15	2	1	½			1/24	
720	30	4	2	1			1/12	
				2	1		1/6	
8640	360	51.42	24	12	6	2	1	
				60	30	10	5	1

Indian Calendar Dates

भारतीय तिथियाँ

तिथि का निर्णय सूर्य और चंद्रमा की पारस्परिक दूरी की नाप से होता है। सूर्य और चंद्रमा की दूरी गज़ या मीलों में नहीं नापी जाती है बल्कि अंशों में नापी जाती है। पृथ्वी सूर्य के चारों ओर घूमती है और चंद्रमा पृथ्वी के चारों ओर घूमता है। इस समय के चक्कर में कभी तो पृथ्वी से देखने वाले को सूर्य तथा चंद्रमा एक ही अंश में दिखाई देते हैं, कभी १८० अंश दूर। इसी अंतर को बताने वाली तिथि है।

जब चंद्रमा सूर्य के ठीक एक अंश पर आकर चंद्रमा आगे बढ़ने लगता है तब इन पंद्रह तिथि के पखवाड़े को शुक्ल पक्ष कहते हैं।जब चंद्रमा सूर्य के ठीक १८० अंश पर पहुच जाता है तो दोनों का फ़ासला कम होना शुरू हो जाता है तब इन पंद्रह तिथि के पखवाड़े को कृष्ण पक्ष कहते हैं।

शुक्ल पक्ष की तिथियाँ		कृष्ण पक्ष की तिथियाँ	
0 अंश से 12 अंश तक	प्रतिपदा (१)	180 अंश से 168 अंश तक	प्रतिपदा (१)
12 अंश से 24 अंश तक	द्वितीया (२)	168 अंश से 156 अंश तक	द्वितीया (२)
24 अंश से 36 अंश तक	तृतीया (३)	156 अंश से 144 अंश तक	तृतीया (३)
36 अंश से 48 अंश तक	चतुर्थी (४)	144 अंश से 132 अंश तक	चतुर्थी (४)
48 अंश से 60 अंश तक	पंचमी (५)	132 अंश से 120 अंश तक	पंचमी (५)
60 अंश से 72 अंश तक	षष्ठी (६)	120 अंश से 108 अंश तक	षष्ठी (६)
72 अंश से 84 अंश तक	सप्तमी (७)	108 अंश से 96 अंश तक	सप्तमी (७)
84 अंश से 96 अंश तक	अष्टमी (८)	96 अंश से 84 अंश तक	अष्टमी (८)
96 अंश से 108 अंश तक	नवमी (९)	84 अंश से 72 अंश तक	नवमी (९)
108 अंश से 120 अंश तक	दशमी (१०)	72 अंश से 60 अंश तक	दशमी (१०)
120 अंश से 132 अंश तक	एकादशी (११)	60 अंश से 48 अंश तक	एकादशी (११)
132 अंश से 144 अंश तक	द्वादशी (१२)	48 अंश से 36 अंश तक	द्वादशी (१२)
144 अंश से 156 अंश तक	त्रयोदशी (१३)	36 अंश से 24 अंश तक	त्रयोदशी (१३)
156 अंश से 168 अंश तक	चतुर्दशी (१४)	24 अंश से 12 अंश तक	चतुर्दशी (१४)
168 अंश से 180 अंश तक	पूर्णिमा (१५)	12 अंश से 0 अंश तक	अमावस्या (१५)

माह

१-चैत्र, २-वैशाख, ३-ज्येष्ठ,

४-आषाण, ५-श्रावण, ६-भाद्रपद ,

७-आश्विन(कुंवार), ८-कार्तिक,

९-मार्गशीर्ष, १०-पौष, ११-माघ, १२-फाल्गुन।

महीनों के नाम

महीनों के नाम	नक्षत्र (पूर्णिम के दिन जिसमें चन्द्रमा होता है)
चैत्र	चित्रा, स्वाति
वैशाख	विशाखा, अनुराधा
जेष्ठ	जेष्ठा, मूल
आषाढ़	पूर्वाषाढ़, उत्तराषाढ़, सतभिषा
श्रावण	श्रवण, धनिष्ठा
भाद्रपद	पूर्वाभाद्र, उत्तरभाद्र
आश्विन (कुंवार)	अश्विन, रेवती, भरणी
कार्तिक	कृतिका, रोहणी
मार्गशीर्ष	मृगशिरा, उत्तरा
पौष	पुनवर्सु,पुष्य
माघ	मघा, अश्लेशा
फाल्गुन	पूर्वाफाल्गुन, उत्तरफाल्गुन, हस्त

ऋतुकाल

ऋतु	माह	सूर्य का राशी में संचार	English calendar Date
शिशिर	माघ	मकर	13 or 14 January
	फाल्गुन	कुम्भ	12 February
वसंत	चैत्र	मीन	14 March
	वैशाख	मेष	13 or 14 April
ग्रीष्म	ज्येष्ठ	वृष	14 or 15 May
	आषाण	मिथुन	15 June
वर्षा	श्रावण	कर्क	16 or 17 July
	भाद्रपद	सिंह	16 or 17 August
शरद	आश्विन(कुंवार) ,	कन्या	17 September
	कार्तिक	तुला	17 October
हेमंत	मार्गशीर्ष	वृश्चिक	15 or 16 November
	पौष	धनु	16 December

अयनकाल

दक्षिणायन- शिशिर, वसंत, ग्रीष्म- ३ ऋतु

माघ, फाल्गुन, चैत्र, वैशाख, ज्येष्ठ, आषाण- ६ मास

उत्तरायण- वर्षा, शरद, हेमंत – ३, ऋतु

श्रावण, भाद्रपद आश्विन(कुंवार), कार्तिक मार्गशीर्ष, पौष- ६ मास

Indian standard time

Throughout India, watches and clocks are adjusted according to IST (Indian Standard Time) and IST is taken for longitude 82 degrees 30 minutes east. This runs almost through the middle of the longitudinal extent of India. So, the local time of 82 degrees and 30 minutes east is considered as Indian Standard Time (IST).

IST is 5½ hours ahead of GMT.

Indian National calendar

In 1952, a committee was appointed to examine the different calendars and suggest an accurate and uniform calendar for the whole of India. Based on the report, the Government of India adopted the National Calendar based on saka era with chaitra as its first month. The days of this calendar have permanent correspondence with the days of the Gregorian calendar. Chaitra 1 falling on March 22 is an ordinary year and March 21 in a leap year. Both Saka and Gregorian calendars are used for official purposes.

SAKA samvat is the era beginning from the year 78 AD. The Indian government from 1957 as the basis for the national calendar adopted it.

In Gregorian-calendar 1 January 1 A. D. was Monday

SI units in India

National Physical Laboratory of India

The National Physical Laboratory of India, situated in New Delhi is the maintainer of SI units in India and calibrates the national standards of weights and measures.

History of the NPL

The National Physical Laboratory is one of the earliest national laboratories set up under the Council of Scientific & Industrial Research. Jawaharlal Nehru laid the foundation stone of NPL on the 4 January 1947. Dr. K. S. Krishnan was the first Director of the laboratory. Former Deputy Prime Minister Sardar Vallabhbhai Patel formally opened the main building of the laboratory on 21 January 1950. Former Prime Minister Indira Gandhi inaugurated the Silver Jubilee Celebration of the Laboratory on 23 December 1975.

For detailed description of basic SI units please refer 'Definitions of the Seven Basic S I Units'

Radiation

The NPL does not maintain standards of measurements for ionizing radiations. This is the responsibility of the Homi Bhabha Atomic Research Centre, Mumbai.

Calibrator of weights & measures

The standards maintained at NPL are periodically compared with standards maintained at other National Meteorological Institutes in the world as well as the BIPM in Paris. This exercise ensures that Indian national standards are equivalent to those of the rest of the world.

Any measurement made in a country should be directly or indirectly linked to the national standards of the country, for this purpose, a chain of laboratories are set up in different states of the country. The weights and measures used in daily life are tested in the laboratories and certified. It is the responsibility of the NPL to calibrate the measurement standards in these laboratories at different levels. In this manner, the measurements made in any part of the country are linked to the national standards and through them to the international standards.

The weights and balances used in local markets and other areas are expected to be certified by the Department of Weights and Measures of the local government. Working standards of these local departments should, in turn, be calibrated against the state level standards or any other laboratory, which is entitled to do so. The state level laboratories are required to get their standards calibrated from the NPL at the national level, which is equivalent to the international standards.

Fundamental units

Several systems of units have been in use for describing measurements. The common systems are the CGS system (centimetre, gram, second) and the FPS system (foot, pound, second) that is the British system, the MKS system (metre, kilogram, second).

From the fundamental CGS (centimetre, gramme, second) units of length, mass, and time, are derived the other units in the table. The British practical system and its relation to the CGS system are as under:

Unit of	**CGS system**	**British practical system**
Length	1 Centimetre	1 Foot =30.4799 centimetres
Mass	1 Gramme	1 Pound = 453.5924 gramme
Time	1 Second	1 Second

Unit of	CGS system	British practical system
Force	1 Dyne	1 Poundal =13825.483 dynes
Work or Energy	1 Erg	1 foot pound = 13565149.15 Ergs (*)
Power of Activity	1 Erg per second	1 Foot pound per second
Velocity	1 cm per second	1 Foot per second
Acceleration	1 cm/second/second	1 Foot per second per second
g	982 cm /second/second	32.2 Feet per second per second
* g = 981.17		

The CGS Units are frequently termed "Absolute" units.

Internationally accepted is the System International & units, abbreviated SI units.

British units (FPS System)

Length

mil	Inch	Feet	Yard	Rod or Pole	Furlong	Mile	Metric
1000	1	0.083	0.02778	0.00505	0.000126	0.0000158	0.0254 metre
12000	12	1	0.333	0.06060	0.001515	0.0001894	0.3048 metre
36000	36	3	1	0.18182	0.004545	0.0005680	0.9144 metre
72000	72	6	2	0.36360	0.009091	0.0011360	1.8288 metres
198000	198	16.5	5.5	1	0.025	0.0031354	5.0292 metres
	7920	660	220	40	1	0.125	201.168 metres
	63360	5280	1760	320	8	1	1609.344 metres

Mile

Admiralty mile	A British unit of length equivalent to 6,080 feet (1,853.184 meters); 800 feet longer than a statute mile
Air mile	A unit of length used in navigation; exactly 1,852 meters; historically based on the distance spanned by one minute of arc in latitude
Geographical mile	A British unit of length equivalent to 6,080 feet (1,853.184 meters); 800 feet longer than a statute mile
Land mile	A unit of length equal to 1,760 yards or 5,280 feet; exactly 1609.344 meters
League (land)	An obsolete unit of distance of variable length (usually 3 miles) 15840 feet= 5280 yards = 3 miles = 4.828 kilometres
Nautical mile (International)	A unit of length used in navigation; exactly 1,852 meters; historically based on the distance spanned by one minute of arc in latitude
Roman mile	An ancient Roman unit of length equivalent to 1620 yards

Sea mile	A former British unit of length once used in navigation; equivalent to 6,000 feet (1828.8 meters)
Statute mile	A unit of length equal to 1,760 yards or 5,280 feet; exactly 1609.344 meters
Metric mile	1500 meters or 1.5 kilometres (approximately 0.932 057 statute mile or 4921.26 feet)
Swedish mile	A Swedish unit of length equivalent to 10 km

Summary of square measures

144 square inches	= 1 square foot		
1296 square inches	=9 square feet	=1 square yd	
272.25 square feet	=30.25 square yd	=1 square Rod	
4356 square feet	=484 square yd	=16 square rods	=1 square chain
10890 square feet	=40 square rods	=1210 square yards	=1 rood
145200 square yd	=Yard of land	=30 acres	=120 rood
4840 square yd	=160 square rods	=1 acre	=10 square chains
6400 Square chains	=640 acres	=1 square mile	=2560 square roods
23040 acres	=36 square mile	=1 township	=93.24 square kilometres
1 square mile	=27878400 square feet	=3097600 square yd	=640 acres (259 hectare)

Area

Square Inch	Sq Feet	Sq Yard	Perch/rod	Rood	Acre	Sq metre
1	0.00694	0.000772	0.0000255	0.00000064	0.000000159	0.00064510
144	1	0.111	0.003670	0.0000918	0.00002300	0.09290300
1296	9	1	0.03310	0.000826	0.0002062	0.83612730
39204	272.25	30.25	1	0.025	0.00625	25.2922853
1568160	10890	1210	40	1	0.25	1011.71410
6272640	43560	4840	160	4	1	4046.85640

Units of Weight

Ton

Ton (tn or T)	unit of weight	A traditional unit of weight equal to 20 hundredweight. In Britain, there are 112 pounds in the hundredweight and 2240 pounds (1016.047 kilograms) in the ton. It is called long ton or gross ton. In the US and Canada, there are 100 pounds in the hundredweight and exactly 2000 pounds (907.185 kilograms) in the ton. It is called short ton or net ton.
ton (t) tonne	metric ton	A metric unit of mass, equal to 1000 kilograms, or approximately 2204.623 pounds avoirdupois. The metric ton is now known officially as the tonne
ton (RT or rT)	cargo capacity	A unit used traditionally to measure the cargo capacity of a merchant ship is exactly 100 cubic feet. (2.8326 cubic meters)
ton (DT or dt	Displacement ton	A unit of volume used traditionally to measure the "displacement" of ships, especially warships. A long ton of sea water occupies about 35 cubic feet.
ton (Feet)	freight ton or revenue ton	A traditional unit of volume used for measuring the cargo of a ship, truck, train, or other freight carrier. This freight ton is exactly 40 cubic feet, or approximately 1.1326 cubic metres.
ton, assay (AT)	mineralogists	A specialized unit of mass used by mineralogists in assaying (testing) ores for the presence of gold, silver, platinum, uranium, or other valuable metals. One assay ton equals 29.1667 grams: just a little over an ounce. The assay ton is actually a sample size. Since there are 87500÷3=29166.7 troy ounces in a short ton (2000 lbs), the number of milligrams of a precious metal in a sample of one assay ton is numerically equal to the number of troy ounces of that metal in one ton of raw ore. In Britain, the assay ton is based on the long ton and thus equals 98÷3 = 32.6667 grams.

ton (tn or T)	energy	A unit of energy used for measuring the energy of an explosion, especially a nuclear explosion. In this usage, one ton is supposed to be the amount of energy released by the explosion of one short ton of TNT. This is defined in the U. S. to equal exactly 4.184 giga joules (GJ) or roughly 4 million Btu.
ton (RT)	power	A unit of power used in refrigeration engineering. One ton of refrigeration is intended to be the power required to freeze one short ton of water at 0°C in 24 hours.
ton	slang	British slang for 100, especially the sum of 100 pounds, a speed of 100 miles per hour, or a score of 100 in darts or cricket.
ton	Shipping	Shipping ton is a traditional unit measuring the volume (not the weight) of items shipped by sea.
ton	freight	A unit of volume for freight that weighs one ton, varying with the type of freight measured, as 40 cubic feet of oak timber or 20 bushels of wheat.

Mass (Avoirdupois)

System of weights, based on the pound of 16 ounces, used in UK & US for the goods other than gems; precious metals, and drugs. 27.34375 grains — make one drachm (dram)

Grains	Drachma	Ounce	Pound	Stone	Quarter	Hundredweight	Ton	Gram approx
1		0.002285						0.065
27.34375	1	0.0625	0.0039					1.772
437.5	16	1	0.0625		0.00223	0.000558	0.000028	28.35
7000	256	16	1		0.0357	0.00893	0.000447	453.59
	3584	224	14	1	0.5	0.125	0.00625	6 350
	7168	448	28	2	1	0.25	0.0125	12 701
	28672	1792	112	8	4	1	0.05	50 802
	573440	35850	2240	160	80	20	1	1016047

100 pounds = 1 cental (US) (one short hundredweight) = 45.359237 kilogram;

20 short hundredweight = 1 short ton;

1 ounce = 2.5 tola;

1 pound = 39.5 tola

Troy weight

It is a system of weights used for precious metals and gemstones; based on a 12-ounce pound and an ounce of 480 grains. For gold and silver the ounce, divided decimally, and not into grains, is the sole unit of weight.

The troy system is practically obsolete today, but the prices of precious metals are still quoted by the troy ounce. (*There is no Troy Pound)

Carat	Grains	Pennyweight	Ounce	Pound*	Quarter	Cwt	Ton	Gram approx
0.25	1	0.04167	0.00208	0.0001736				0.065
1	4	0.16668	0.00832	0.0006944				0.259
6	24	1	0.05	0.004167				1.555
120	480	20	1	0.0833				31
1440	5760	240	12	1				373.242
		6000	300	25	1	0.25		9331
		24000	1200	100	4	1	0.25	37324
		480000	24000	2000	80	20	1	746484

Apothecaries Weight (Dry)

A system of weights used chiefly in compounding and dispensing drugs. In the apothecary system, the ounce is divided into 8 drams (60 grains) each containing 3 scruples (20 grains); an ounce is equal to 480 grains and a pound is equal to 12 ounces

Drachma: A British Imperial capacity measure (liquid or dry) equal to 60 minims or 3.5516 cubic centimetres

Grain	Scruple	Drachma	Ounce	Pound	Gram
1	0.05	0.01667	0.00208	0.0001736	0.0648
20	1	0.3333	0.04167	0.00347	1.296
60	3	1	0.125	0.01042	3.888
480	24	8	1	0.0833	31.104
5760	288	96	12	1	373.248

Apothecary's Liquid Measures (weight)

1 minim or drop	=1/60 fluid drachma	=1/480 fluid ounce	=0.003 612 cu in	=59.194 micro litres
20 minims	= 1 fluid scruple	=1/24 fluid ounce	=0.07224 cu in	= 1.1839 millilitres
3 fluid scruples	=1 fluid drachma	=1/8 fluid ounce	=0.21672 cu in	= 3.5516 millilitres
8 fluid drachms	=1 fluid ounce	=0.05 pint	=1.733 871 cu in	= 28.413 063 millilitres
20 fluid ounces	=1 pint	=1 pint	=34.67774 cu in	= 568.26126 millilitres

fluid ounces: 1. A British Imperial unit of capacity or volume (liquid or dry) equal to 8 fluid drams or 28.416 cubic centimetres (1.734 cubic inches)

Capacity Dry (Commodities)

Dry measure is the system of volumetric units used in measuring dry commodities, as fruits or grains.

A quart for dry measure of capacity equals to one eight of a peck, or 67.201 cubic inches (1.101 litres)

Table-1

Gill	Pint	Quart	Gallon	Peck	Bushel	Litre
1	¼					0.1425
4	1					0.57
8	2	1				1.136
16	4	2				1.89
32	8	4	1			4.545
64	16	8	2	1		9.09
		32	8	4	1	36.36

Table-2

4 Pecks	= 1 Bushel	Gill: A British imperial capacity unit (liquid or dry) equal to 5 fluid ounces or 142.066 cubic centimetres 1 US bushel =2152.42 Cubic inches or 35.24 litres British imperial bushel = 2219.36 cubic inches= 36.38 litres
3 Bushels	= 1 Bag	
4 Bushels	= 1 Coomb	
5 Bushels	= 1 Sack	
8 Bushels	= 1 Quarter	

Capacity liquid

Pints	Gallon	Quart	Cubic feet	Litres
1	0.125	½	0.020051	0.57
2	0.25	1	0.040102	1.136
8	1	4	0.16046	4.548
16	2	8	0.32092	9.087
34.845	4.3556	17.4225	1	28.3154
64	8	32	1.28367	36.34766
512	64	256	10.269	290.781
800	100	400	16.046	454.80

The British Imperial pint is equal to 20 British fluid ounces = 34.678 cubic inches,

or approximately 568.261 millilitres.

1 British imperial gallon = 1.20 US liquid gallons;

1 US liquid gallon = 0.8333333 British imperial gallon

1 UK pint = 0.57 litre; 1 US pint = 0.47 litre

Gallon

Gallon	Pint	Fluid pound	Fluid ounce	Fluid dram	minim/drop	Metric
1	8	10	160	1120	67200	4.545 litres
	1	1¼	20	140	8400	568 millilitres
		1	16	112	6720	455 millilitres
			1	7	420	28 millilitres
				1	60	4 millilitres

Volume

Cubic inch	Cubic feet	Cubic Yard	cubic Metres or stere
1	=0.0005787	=0.0002143	=0.0000163871
1728	=1	=0.03704	=0.02831685
46656	=27	=1	=0.764559

277.4194 Cubic inches = 1 imperial gallon; 1 cu inch = 16.3871 millilitres = 0.5767 British Imperial fluid ounce; 1 cubic foot = 6.2288 British imperial gallons

Fathoms: (mining) a unit of volume (equal to 6 cubic feet) used in measuring bodies of ore

A dram

160 Drops of wine	= 1 Dram
60 Drops of sulphuric acid	= 1 Dram
45 Drops of hydro cynic acid	= 1 Dram
50 Drops of distilled water	= 1 Dram
150 Drops of ether	= 1 Dram

Wood measure

Board foot = A piece of lumber one foot square and one inch thick = 144 cubic inches (2.359737 cubic decimetre)

16 cubic feet = 1 cords foot; 8 cord feet = 1 cord

Stack of wood = 108 cubic feet = 3.06 cubic metres

A cord of wood = 128 cubic feet (8 feet long x 4 feet wide x 4 feet high) = 3.6246 cubic metres. 1 Petrograd standard = 165 cubic feet sawn timber (4.76228 cubic metres)

Measures Having Household Usage

Measure	Where used	Equals	Millilitres
1 coffee cup		5 fluid ounces	=150
1 cup	Breakfast cup	½ imperial pint = 10 imperial fl oz or 1.20 US cup	=284
1 cup	UK	10 fluid ounces	= 284
1 cup	US	8 fluid ounces (½ liquid pint)	= 236.6

Measure	Where used	Equals	Millilitres
1 cup	Canada	8 fluid ounces	= 227.3
1 cup	Australia		=250
1 cup	Russian (chakra)	4.329 imperial fl oz or 4.159 US fl oz	=123
1 cup	Japanese	¾ US cup (dry & liquid)	=180

Miscellaneous measures

Drop (Gutta)

1 drop (pharmacy) = 0.05 milliliter (20 drops/ml)

1 drop (informal unit of volume) = 0.051 milliliter

1 drop = 1 minim (59.194 micro liters)

Minim: 1. A British imperial capacity measure (liquid or dry) equal to 1/60th fluid dram or 0.059194 cubic centimetres

2. A United States liquid unit equal to 1/60 fluidram

Spoon measures

Drop	Pinch	Dash	Salt spoon	Coffee spoon	Tea spoon	Dessert spoon	Table spoon	Milliliter	Fluid ounce	Indian
1					1/100			0.051	1/576	
	½				1/32	1/64		0.15	0.005	
	1	½			1/16	1/32		0.03	0.01	
		1			1/8	1/16		0.06	0.02	
24			1		¼	1/8		1.2	0.04	
			2	1	½	¼	1/6	2.5	1/12	1 masha
			4	2	1	½	1/3	5	1/6	2 masha
			8	4	2	1	2/3	10	1/3	4 masha
					3		1	15	½	6 masha

Spoonful = teaspoonful; 1 tablespoonful = 1 palm-full

1 centilitre = 2 US teaspoons (or 0.704 British tablespoonfuls).

A pat of butter in US is typically 2 teaspoons (⅓ fluid ounce, or about 10 millilitres).

A centilitre is roughly equal to 2 US teaspoons (or 0.704 British tablespoonfuls).

Surveyor's Measure

Inch	Link	Chain	Pole	Furlong	Mile	Equivalent CGS unit
7.92	= 1	= 0.01	= 0.04	→	=0.000125	= 20.1164 centimetres
792	= 100	= 1	= 4	= 0.01	= 0.0125	= 20.1168 metres
7920	= 1000	= 10	= 40	= 1	= 0.125 (⅛)	= 201.168 metres
63306	= 8000	= 80	= 320	= 8	= 1	= 1.609344 kilometres
39336.53	=4970.97	=49.71	=198.84	=4.97	= 0.6214	= 1 kilometre

1 chain = 4 rods = 1/80 miles =1/10 furlong = 22 yards = 66 feet; 10 square chain = 1 acre

Survey mile: A U.S. unit of measure equal to 1609.347 meters; derived from the use of 39.37 inches as the conversion for one meter

Mariner's Measure

Feet	Fathom	Cable length	Nautical mile	League	Equivalent CGS unit
6	= 1	=0.01			= 1.8288 metres
600	= 100	= 1	=0.01		= 182.88 metres
	1000	=10	= 1		= 1828.8 metres
			3	= 1	= 5486.4 metres

Some navies are now using a metric cable equal to exactly 200 metres (about 656.17 feet).
60 nautical miles=1 degree (at the equator)

Mariner's Speed

1 Nautical mile =1 Knot (sea mile per hour)

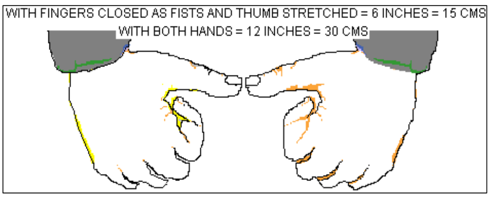
1 Nautical mile =6077.18 feet or 1853.54 metres

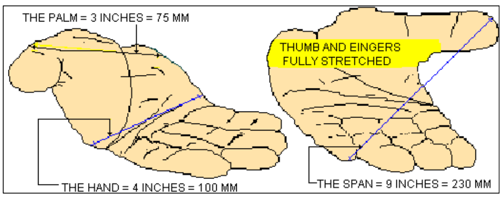
Admiralty knot =6080 per hour feet = 1.1515 per hour miles

US Knot =6080.2 feet per hour

Telegraph knot =6087 feet per hour

Common measures





Hair's breadth - as a rough standard, a hair's breadth is 100 µm or 0.1 millimetres.
1 Pace or stride = 2½ feet
Step is a traditional unit of distance, equal to ½ pace. The step is traditionally equal to 30 inches or 76.2 centimetres.

1 foot = 3 hands = 4 palms = 12 inches (thumb widths) = 16 digits (finger widths)
Nail: was used for measuring cloth; traditionally, it represented the length of the last two joints (including the fingernail) of the middle finger. The nail is equivalent to yard, ¼ span, 2.25 inches, or exactly 5.715 centimetres
1 finger (unit of distance) =2 nails = 4.5 inches = 114.3 millimetres. This unit represents the length of the middle finger, from the tip to the joint where the finger is attached to the hand.
Palm: a traditional unit of distance equal to the width of a person's palm. The palm equals 4 digits or 1/6 cubit, which is about 3 inches or 7.5 centimetres.
Fist: an informal unit of distance equal approximately to the hand (10 centimetres or 4 inches). The unit represents the width of a clenched fist.
Hand: A traditional unit of distance now used mostly to measure the height of horses. One hand equals 4 inches, 1/3 foot, or 10.16 centimetres.
Forearm with hand straight = 42 to 52 centimetres
Arm's length: length of a human arm is standardized as a unit of distance equal to about 70 centimetres or 28 inches
Stone's throw: 50 metres (164 feet)
Arm's length: the length of a human arm is standardized as a unit of distance equal to about 70 centimetres or 28 inches.

Sundry Measures

20 units = A Score or Kauri

12 Units = 1 dozen; 13 units = baker's dozen or devil's dozen

5 dozen = 1 shock or shook

12 dozen = A gross = 144 units

One dozen gross = great gross = 1728 units

Great hundred is a traditional quantity equal to 120 instead of 100 = 6 scores = 2 shook

A seam of glass = 120 pounds = 54.43 kilograms

A fagot* of steel = 120 pounds = 54.43 kilograms. (*fagot – a bundle; bunch)

Animal power

Pounds or kilogram raised feet per minute

Horse	= 21,600 or 9806 kilogram
Ox	= 12,000 or 5448 kilogram
Mule	= 10,000 or 4540 kilogram
Ass	= 3,500 or 1589 kilogram
Man as in rowing	= 4,000 or 1816 kilogram
Man on tread-wheel	= 3,100 or 1407 kilogram
Man running a handle	= 600 or 272 kilogram

British & American capacity measures

British	Qty	American
4.548 litres	←1 gallon→	3.79 litres
10 pound of water	←1 gallon→	8.33 pound of water
0.57 litre	←1 pint→	0.47 litre
1.136 litre	←1 quart→	0.95 litre
35.195 080 34 fluid ounces	←2.2 fluid pound→	33.814 023 34 fluid ounces

The imperial gallon equals 1.20095 US liquid gallons

US Customary Weights & Measures

American currency

100 cents	1 dollar	Drams: The basic unit of money in Armenia
25 cents	a quarter	RED CENT– a very small amount of money
10 cents	a dime	Quarter = A coin worth one fourth of a dollar
5 cents	a nickel	One mill = one thousandths of a US dollar

1-slug = a gold coin of California, issued in 1849 and worth 50 dollars at that time

Length

12 inches = 1 foot (feet)
3 feet = 1 yard (yd)
5 ½ yards = 1 rod (rd), pole, or perch (16 ½ feet)
40 rods = 1 furlong (fur) =220 yards= 660 feet
8 furlongs = 1 statute mile (mi) = 1,760 yards=5,280 feet
3 miles = 1 league = 5,280 yards= 15,840 feet
1 international nautical mile = 6076.11549 feet

Mariner's Measure

Feet	Fathom	Cable length	Equivalent CGS unit
720	= 120	= 1	= 219.456 metres

Gunter's or Surveyor's Chain Measure

7.92 inches = 1 link
100 links = 1 chain = 4 rods= 66 feet
80 chains = 1 statute mile (mi) = 320 rods= 5,280 feet

Volume

Liquid Measure

4 gills = 1 pint = 28.875 cubic inches
4 quarts = 1 gallon = 8 pints = 231 cubic inches = 32 gills
2 pints = 1 quart = 57.75 cubic inches
1 pint = 16 fluid ounces

Dry Measure

2 pints = 1 quart = 67.2006 cubic inches
8 quarts = 1 peck = 537.605 cubic inches= 16 pints
4 pecks = 1 bushel = 2,150.42 cubic inches= 32 quarts

Area

144 square inches	= 1 square foot (ft^2)
9 square feet	= 1 square yard (yd^2) = 1,296 square inches
30 ¼ square yards	= 1 square rod (rd^2) = 272¼ square feet
160 square rods	= 1 acre = 4,840 square yards= 43,560 square feet
640 acres	= 1 square mile (mi^2)
1 mile square	= 1 section (of land)
6 miles square	= 1 township= 36 sections= 36 square miles

Cubic Measure

1 cubic foot	= 1,728 cubic inches
27 cubic feet	= 1 cubic yard

Weight

Avoirdupois Weight

27- 11/32 grains	= 1 dram
16 drams	= 1 ounce = 437 ½ grains
16 ounces	= 1 pound = 256 drams= 7,000 grains
100 pounds	= 1 hundredweight*
20 hundredweights	= 1 ton = 2,000 pounds*

In gross or long measure, the following values are recognized.

112 pounds	= 1 gross or long hundredweight*
20 gross or long hundredweights	= 1 gross or long ton= 2,240 pounds*

*When the terms "hundredweight" and "ton" are used unmodified, they are commonly understood to mean the 100-pound hundredweight and the 2,000-pound ton, respectively; these units may be designated "net" or "short" when necessary to distinguish them from the corresponding units in gross or long measure.

Troy Weights

24 grains	= 1 pennyweight
20 pennyweights	= 1 ounce
1 ounce	=480 grains
12 ounces	= 1 pound
1 pound	=5760 grains

Apothecary's Weights

20 grains	= 1 scruple
3 scruples	= 1 dram
8 drams	= 1 ounce (480 grains)
12 ounces	= 1 pound (5760 grains)

Apothecary's Measures

60 minims	= 1 fluid dram
8 fl drams	=1 fluid ounce
16 fl ounces	= 1 pint

Note- particularly that the US gallon is a different size to the UK gallon so that no liquid measures of the same name are the same size in the US and UK systems.

In addition, that the ton (US) is 2000 pounds while a ton (UK) is 2240 pounds. These are also referred to as a short ton and long ton respectively.

Note- that in matters concerned with land measurements, for the most accurate work, it is necessary to establish whether the US survey measures are being used or not

Misc

Liquid measures (Food recipes)

1 wine glassful	=5 tablespoonfuls	2.5 fluid ounces= ½ gill	= 71 millilitres
1-half wine glassful	=1 ounce	=2.5 tola	= 35.5 millilitres
1-small wine glassful	=2 ounces	=5 tola	= 71 millilitres
1-break-fast cupful	=8 ounces	=1 pau (1/4 seer)	= 284 millilitres
1-tea cupful	=5 fluid ounces	8.67 cubic inches	= 137.7 millilitres

Wine & spirit measure

4 Gills	= 1 Pint
2 Pints	= 1 Quart
4 Quarts	= 1 Gallon
31½ Gallons	= 1 Barrel
2 Barrels	= 1 Hogshead
4 Hogshead	= 1 Ton

Wine/Spirits bottle/barrel

Balthazar	A wine bottle holding 12 litres (13 quarts)
Barrique	French wine barrel = 225 litres
Demi	A half bottle of wine = 375 ml
Double magnum	Wine bottle of 3 litres. It is also called a jeroboam

Fifth	A fifth part of a gallon of liquor; $^4/_5$ of a quart (about 750 millilitres)
Imperial	wine bottle of 6 litres, it is also called Methuselah
Jeroboam	A large wine bottle having a capacity of about four ordinary bottles or 3 litres (3.3 quarts)
Jigger	A measure of 1½ ounce (45 ml) used in cocktail recipes.
Magnum	Large wine bottle having a capacity of two ordinary bottles, or 1.5 litres (1.6 quarts)
Methuselah	A wine bottle holding 6½ quarts (6 litres)
Nebuchadnezzar	A bottle for wine holding 20 quarts (18.9 litres)
Nebuchadnezzar	wine bottle of 15 litres
Pony	A small beverage bottle, often holding seven ounces (196 grains)
Rehoboam	wine bottle of 4.5 litres
Salmanazar	wine bottle of 9 litres
Split	small wine bottle of 187.5 millilitres =4 jiggers
Wine bottle	750 ml = 25.3605 US fl oz = 26.3963 imperial fl oz

Champagne/brandy/wine

Pony	0.5 jigger			30 millilitres	US Barrel beer = 31 gallons =4.145 cu ft = 117.35 litres UK Barrel = 36 imperial gallons = 5.78 cu ft = 163.66 litres
Shot	0.666 jigger		1 ounce	40 millilitres	
Jigger	1.5 shots		1.5 ounce	45 millilitres	
Pint	16 shots	0.625 fifth	16 ounce	720 millilitres	
Fifth	25.6 shots	1.6 pints	0.8 quart	0.75 litre	
Quart	32 shots	1.25 fifths	1 quart	0.95 litre	

Interrelation of units of measurement

Units of Capacity (Liquid measure) US

Units↓	Minims	Fluid drams	Fluid ounces	Gills	Liquid pint	Liquid quarts
1 minim	1*	0.0166667	0.00208333	0.000520833	0.000130208	0.000 06510417
1 fluid dram	60*	1*	0.125*	0.03125*	0.0078125*	0.003 90625*
1 fluid ounce	480*	8*	1*	0.25*	0.0625*	0.031 25*
1 gill	1920*	32*	4*	1*	0.25*	0.125*
1 liquid pint	7680*	128*	16*	4*	1*	0.5*
1 liquid quart	15 360*	256*	32*	8*	2*	1*
1 gallon	61 440*	1024*	128*	32*	8*	4*
1 cubic inch	265.974	4.432900	0.5541126	0.1385281	0.03463203	0.01731602
1 cubic foot	459 603.1	7660.052	957.5065	239.3766	59.84416	29.92208
1 litre	16 230.73	270.51218	33.81402	8.453506	2.113376	1.056688

And

Units	Gallons	Cubic inches	Cubic feet	Litre
1 minim	0.00001627604	0.003759766	0.000002175790	0.00006161152
1fluid dram	0.0009765625*	0.2255859	0.0001305474	0.003696691
1 fluid ounce	0.0078125*	1.8046875*	0.001044379	0.02957353
1 gill	0.03125*	7.21875*	0.004177517	0.118294118
1 liquid pint	0.125*	28.875*	0.01671007	0.473176473
1 liquid quart	0.25*	57.75*	0.03342014	0.946352946
1 gallon	1*	231*	0.1336806	3.785411784
1 cubic inch	0.004 329004	1*	0.0005787037	0.016387064
1 cubic foot	7.480 519	1728*	1*	28.316 846 592*
1 litre	0.26417205	61.023 74	0.035 314 67	1

Units of Capacity (Dry Measure) US

Units↓	Dry pints	Dry quarts	Pecks	Bushels	Cubic in.	Litres
1 dry pint	1*	0.5*	0.062 5*	0.015625*	33.6003125*	0.55061047
1 dry quart	2*	1*	0.125*	0.03125*	67.200625*	1.1012209
1 peck	16*	8*	1*	0.25*	537.605*	8.8097675
1 bushel	64*	32*	4*	1*	2150.42*	35.23907
1 cubic inch	0.0297616	0.0148808	0.00186010	0.000465025	1*	0.01638706
1 litre	1.816166	0.908083	0.11351037	0.02837759	61.02374	1*

Foreign length measures

Country where used	Measures	UK equivalent	Metric equivalent
Argentina	Vara	34.0944 inches	86.599776 centimetres
Chile; Costa Rica	Vara	32.913 inches	83.59902 centimetres
China	Ch'ih	12.60 inches	32.004 centimetres
China	Li	1890 feet	576.072 metres
China	Li	0.0126 inch	3.2004 millimetres
China	Ts'un	1.26 inches	3.004 centimetres
Cuba	Vara	33.386 inches	84.80044 centimetres
Denmark	Mil	4.68 mile	7.53012 kilometre
Egypt	Pic	22.83 inches	57.9882 centimetres
Guatemala	Vara	32.909 inches	83.58886 centimetres
Honduras	Milla	1.1493 mile	1.8492237 kilometre
Honduras	Vara	32.874 inches	83.49996 centimetres
Japan	Cho	357.90 feet	109.08792 metres
Japan	Ken	5.965 feet	1.818132 metres
Japan	Shaku	11.9303 inches	30.302962 centimetres
Japan	Sñ n	1.193 inches	3.03022 centimetres
Mexico	Vara	32.992 inches	83.79968 centimetres
Nicaragua	Milla	1.1594 mi	1.8654746 kilometre
Nicaragua	Vara	33.057 inches	83.96478 centimetres
Peru	Vara	32.913 inches	83.59902 centimetres
Russia	Arshin	28 inches	71.12 centimetres
Russia	Sagene	7 feet	2.1336 metres
Russia	Verst	0. 663 mile	1.066767 kilometre
Turkey	Pik	27.9 inches	70.866 centimetres

Foreign weights & measures

Country where used	Weight measures	UK equivalent	Metric equivalent
Argentina	Arroba	25.32 pound	11.49528 kilogram
Argentina	Libra	1.0128 pound	0.4598112 kilogram
Argentina	Quintal	101.3 pound	45.9902 kilogram
Bolivia	Marco	0.507 pound	0.230178 kilogram
Brazil	Arroba	32.38 pound	14.70052 kilogram
Brazil	Quintal	129.54 pound	58.81116 kilogram
Central America	Libra	1.014 pound	0.460356 kilogram
Chile	Libra	1.014 pound	0.460356 kilogram
Chile	Quintal	101.43 pound	40.04922 kilogram
China	Catty	1.333 pound	0.605182 kilogram
China	Picul	133.33 pound	60.53182 kilogram
Cuba	Arroba	25.36 pound	11.51344 kilogram
Cuba; Peru	Libra	1.0143 pound	0.4604922 kilogram

Country where used	**Weight measures**	**UK equivalent**	**Metric equivalent**
Denmark	Pund	1.102 pound	0.500308 kilogram
Denmark	Centner	110.23 pound	50.04442 kilogram
Egypt	Kantar	99.05 pound	44.9687 kilogram
Egypt	Oke	2.7514 pound	1.2491356 kilogram
Greece	Drachm	49.38 grains	3.203485082 gram
Country where used	Weight measures	UK equivalent	Metric equivalent
Greece	Mina	0.95 pound	0.4313 kilogram
Greece	Oke	2.82 pound	1.28028 kilogram
Indonesia	Catty	1.36 pound	0.61744 kilogram
Indonesia	Picul	136.16 pound	61.81664 kilogram
Israel	Rotl	6.35 pound	2.8829 kilogram
Japan	Kin	1.323 pound	0.600642 kilogram
Japan	Kwan	8.267 pound	3.753218 kilogram
Mexico	Libra	1.01467 pound	0.46066018 kilogram
Mexico	Quintal	101.47 pound	46.06738 kilogram
Morocco	Artel	1.12 pound	0.50848 kilogram
Morocco	Kantar	112 pound	50.848 kilogram
Norway	Centner	110.23 pound	50.04442 kilogram
Paraguay	Arroba	25.32 pound	11.49528 kilogram
Philippines	Picul	139.44 pound	63.30576 kilogram
Russia	Berkovets	361.128 pound	163.952112 kilogram
Russia	Funt	0.9028 pound	0.4098712 kilogram
Russia	Pood	36.113 pound	16.395302 kilogram
Spain	Frail (raisins)	50 pound	22.7 kilogram
Spain	Libra	1.014 pound	0.460356 kilogram
Spain	Quintal	220.4 pound	100.0616 kilogram
Sweden	Centner	93.7 pound	42.5398 kilogram
Sweden	Skalpund	0.937 pound	0.425398 kilogram
Turkey	Kantar	124.45 pound	56.5003 kilogram
Turkey	Oke	2.826 pound	1.283004 kilogram
Uruguay	Libra	1.0127 pound	0.4597658 kilogram
Venezuela	Arroba	25.40 pound	11.5316 kilogram
Venezuela	Libra	1.0143 pound	0.4604922 kilogram
World	Carat (metric)	3.086 grains	0.200 gram

Foreign Area measures

Country where used	**Area measures**	**UK equivalent**	**Metric equivalent**
Argentina	Cuadra	4.2 acres	1.701 hectare
Austria	Joch	1.422 acres	0.57591 hectare
Costa Rica	Manzana	1.727 acres	0.699435 hectare
Cuba	Caballeria	33.162 acres	13.43061 hectare
Denmark	Tonde (land)	1.36 acres	0.5508 hectare
Egypt	Feddan	1.038 acres	0.42039 hectare
Hungary	Joch	1.067 acres	0.432135 hectare
Iran	Jerib	2.471 acres	1.000755 hectare
Israel	Dunam	0.22239 acre	0.09006795 hectare
Japan	Cho (land)	2.4506 acres	0.992493 hectare
Japan	Tsubo	35.58 square feet	3.305382 Square metres
Nicaragua	Manzana	1.742 acres	70551 hectare
Paraguay	Cuadra	1.85 acres	0.74925 hectare
Country where used	Weight measures	UK equivalent	Metric equivalent
Poland	Vloka	41.50 acres	16.8075 hectare
Russia	Dessiatine	2.6997 acres	1.0933785 hectare
Sweden	Tunnland	1.22 acres	0.4941 hectare
Uruguay	Cuadra	1.82 acres	0.7371 hectare

Foreign Capacity measures

Country where used	**capacity measures**	**US equivalent**	**Metric equivalent**
Argentina	Baril	20.077 gallon	75.991445 litres
Argentina	Frasco	2.51 liquid quart	2.76404212 cubic metres
Central America	Centaro	4.2631 gallon	16.1358335 litres
Chile	Fanega	2.75268 bushel	97.0018832 cubic decimetre
Cuba; Spain	Arroba (liquid)	4.263 gallon	16.135455 litres
Denmark	Tonde (cereal)	3.948 bushel	139.1238483 cubic decimetre
Ecuador	Fanega (dry)	1.5745 bushel	55.48391571 cubic decimetre
Egypt	Ardeb	5.6189 bushel	198.0048104 cubic decimetre
El Salvador	Fanega (dry)	1.5745 bushel	55.48391571 cubic decimetre
Guatemala; Spain	Fanega (dry)	1.57744 bushel	55.58751858 cubic decimetre

Country where used	capacity measures	US equivalent	Metric equivalent
Japan	Koku	5.119 bushel	180.38887993 cubic decimetre
Japan	To	2.05 peck	18.0600244 cubic decimetre
Mexico	Baril	20.0787 gallon	75.9978795 litres
Mexico	Fanega	2.57716 bushel	90.81672164 cubic decimetre
Poland	Garniec	1.0567 gallon	3.9996095 litres
Portugal	Almude	4.423 gallon	16.77512 litres
Russia	Chetvert	5.957 bushel	209.9191399 cubic decimetre
Russia	Vedro	3.249 gallon	12.297465 litres
Spain	Fanega (liquid)	16 gallon	60.56 litres
Sweden	Tunna (wheat)	4.16 bushel	146.5945312 cubic decimetre
Uruguay	Fanega	3.888 bushel	137.0095041 cubic decimetre
Venezuela	Arroba (liquid)	4.263 gallon	16.135455 litres
Venezuela	Fanega	3.334 bushel	117.4870593 cubic decimetre

Nautical mile

Each meridian of the earth is a semi-circle. The arc of a meridian (longitude) from the pole to the equator subtends an angle of 90 degrees at the centre of the earth. One degree has 60 minutes, the length of one minute of longitude, on the surface of the earth, which subtends an angle of one minute at the centre of the earth, is a nautical mile. The length of one nautical mile is 6080 feet. A terrestrial mile has a length of 5280 feet. This distance was passed by a decree of Queen Elizabeth I. A terrestrial mile is also known as a "statute mile."

We measure distance on the land in kilometres and metres. Imperial units for measuring distances are in inch, foot, yard, and mile. 12 inches (12″) =1 foot (1′) and 3 feet = 1 yard and 1760 yards = 1 mile. Nevertheless, navigators make use of neither metric units or of imperial units while measuring distances on the surface of the earth. The unit of distance for measuring distance on the earth's surface by the navigators is closely linked with the position finding of heavenly bodies involves angular measurements. The angular measurement is in degrees and minutes. One degree contains 60 minutes written as 60'. Minute is 1/60th of a degree and it is written as 1'. Navigators find it convenient to use

'Nautical Mile' for measuring distances on the surface of the earth. A Nautical Mile is the length of an arc of the earth's surface, which subtends an angle of 1 degree at the centre.

If 'A' and 'B' are two points on the surface and 'O' is the centre of the earth, then the distance AB is 1 Nautical Mile if angle A O B is '1'. Nautical mile is abbreviated as 'n mile'; but in common practice we use the same symbol which we use for a minutes. Thus, 100 miles can be written as 100′.

The equator and the meridians are all great circles and as such, they have the same length. A Nautical mile can also be defined as one arc of a meridian. This will help us in finding the length of a Nautical mile in terms of metric units and we shall be able to establish relationship between kilometre, mile, and Nautical mile.

The whole of the equator subtends an angle of 360 degrees at the centre of the earth.

$360° = 360 \times 60' = 21600'$

Therefore one Nautical mile or one nautical mile = (1÷21600) of the length of the equator.

The length of the equator = 2π × 6372 kilometres (the radius of the earth is 6372 kilometres approximately)

Hence one Nautical mile = (2π × 6372×100) ÷ 21600 = 1853.54 metres (approx)

1 standard mile = 5280 feet = 1.6093 kilometres

[One standard mile ÷ 1 Nautical mile] = 1.6093 ÷ 1.8526 = 0.868

That is standard mile = 0.868 Nautical mile OR 1 Nautical mile = 1.152 standard mile.

The word "Knot" stands for the speed of "1 Nautical mile per hour." Hence, the word "Knots per hour" should not be used.

Miles × 0.87 = knots; Knots × 1.15 = miles; Feet per minute × 0.01 = Knots per hour

Nautical measure

Nautical: anything relating to navigation or sea

Knot= Sea mile per hour i.e. = 1.150776 mile per hour.

= 6076.1 feet per hour = 1852 metres per hour

1000 fathoms (approx) = 1 nautical mile

Tyre pressure

Pounds per square inch	20	22	24	26	28	30	32	34
Kilogram per square centimetre	1.41	1.55	1.69	1.83	1.97	2.11	2.25	2.39

Wheels

Numbers of revolutions (F P S units)

Diameter of wheel	**Number of revolutions**	**Diameter of wheel**	**Number of Revolutions**
Feet	Per mile	Feet	Per mile
2	840	5.5	305.5
2.5	672	6	280
3	560	6.5	258.5
3.5	480	7	240
4	420	8	210
4.5	373	9	187
5	336	10	168

Numbers of revolutions (Metric units)

Diameter of wheel	**Number of revolutions**	**Diameter of wheel**	**Number of Revolutions**
Metre	Per Kilometre	Metre	Per Kilometre
0.30	1060	1.00	318
0.45	707	1.25	254.5
0.50	636.5	1.50	212
0.60	530.5	1.75	182
0.75	424	2.00	159
0.90	353.5	2.25	141.5

Stopping distances motor vehicles

At various speeds (High Way Code)

Speed	**Distance**			
	Reaction	**Breaking**	**Overall stopping**	**Sight**
Kilometre per hour	**Metre**	**Metres**	**Metres**	**Metres**
20	4	2	6	16
30	8	4	12	28
50	10	15	25	50
60	12	20	32	80
80	15	40	55	120

Clothing sizes

(All sizes equivalents are approximate)

Men's suit & coats

British	36	38	40	42	44	46	48
American	36	38	40	42	44	46	48
Continental	46	48	50	52	54	56	58

Men's shirt

British	14	14½	15	15½	16	16½	17
American	14	14½	15	15½	16	16½	17
Continental	36	37	38	39/40	41	42	43

Women's dress & suits

British	8	10	12	14	16	18
American	—	8	10	12	14	16
Continental	—	38	40	42	44	46

Men's socks

British	9½	10	10½	11	11½	12
American	9½	10	10½	11	11½	12
Continental	39	40	41	42	43	44

Measuring Unit for Footwear

Different countries follow different systems. English sizes are measured in inches and difference between two sizes is one-third of an inch. A foot measuring 11 inches would mean size 8. French sizes are measured in centimetres and difference between two sizes is two- thirds of a centimetre. Size 42 would mean a foot measuring 27.91 centimetres (11 inches). CIS sizes are measured in millilitres and difference between two sizes is approximately 10 millimetres. A foot measuring 11 inches would mean size 280. For American sizes, add ½ to English size. Thus, English size 8 is equal to French size 42, CIS size 280, and American size 8½. India follows the English system.

(Shoe size in Britain based on the length of the last, measured in barleycorns (thirds of an inch) starting from the smallest practical size, which is size zero.

Men's Shoes

British	7	7½	8½	9½	10½	11
American	8	8½	9½	10½	11½	12
Continental	41	42	43	44	45	46

Women's Shoes

British	4½	5	5½	6	6½	7
American	6	6½	7	7½	8	8½
Continental	38	38	39	39	40	41

Atomic Energy

Atomic Weight

Atomic weight is measured in Mass Units where that of oxygen is taken as exactly 16.000.

1 M v = (1/L) gramme = 1.67 × 10^{24} gramme, where L = 6.025 × 10^{23} and is called the Loschmidst or Avogadro's number.

Atoms per CM^2 = (density × 6.025 × 10^{23}) ÷ Atomic weight

Atomic Number	Element	Symbol	Atomic Weight	Density Gram/Cm³	Natoms/cm² × 10^{-24}	Absorption In barns	Scattering In barns
1	Hydrogen	H	1.008	0.08988×10^{-3}	0.5370×10^{-3}	0.320	38
2	Helium	He	4.003	0.17847×10^{-3}	0.02686×10^{-3}	0.0070	0.8
3	Lithium	Li	6.940	0.534	0.04634	71.0	1.4
4	Beryllium	Be	9.013	1.8	0.1203	0.010	7
5	Boron	B	10.82	2.35	0.1308	755	4
6	Carbon	C	12.01	1.65	0.08275	0.0032	4.8
7	Nitrogen	N	14.008	1.25055×10^{-3}	0.05377×10^{-3}	1.88	10
8	Oxygen	O	16.000	1.42904×10^{-3}	0.05379×10^{-3}	< 0.0002	4.2
9	Fluorine	F	19.00	1.696×10^{-3}	0.05376×10^{-3}	< 0.010	3.9
10	Neon	Ne	20.183	0.90035×10^{-3}	0.02687×10^{-3}	< 2.8	2.9
11	Sodium	Na	22.997	0.971	0.02543	0.505	4.0
12	Magnesium	Mg	24.32	1.74	0.04309	0.063	3.6
13	Aluminium	Al	26.98	2.609	0.06025	0.230	1.4
14	Silicon	Si	28.09	2.42	0.05189	0.13	1.7
15	Phosphorus	P	30.975	2.2	0.04278	0.19	5
16	Sulphur	S	32.066	2.0	0.03757	0.419	1.1
17	Chlorine	Cl	35.457	3.214×10^{-3}	0.05460×10^{-3}	31.6	16
18	Argon	A	39.944	1.7837×10^{-3}	0.02690×10^{-3}	0.62	1.5
19	Potassium	K	39.1	0.87	0.0134	1.97	1.5
20	Calcium	Ca	40.08	1.55	0.02329	0.43	-
21	Scandium	Sc	44.96	3.02	0.04046	24	24
22	Titanium	Ti	47.9	4.5	0.05658	5.6	4
23	Vanadium	V	50.59	5.96	0.07043	5.1	5
24	Chromium	Cr	52.01	7.1	0.08222	2.9	3
25	Manganese	Mn	54.93	7.2	0.07895	13.2	2.3
26	Iron	Fe	55.85	7.87	0.08487	2.53	11
27	Cobalt	Co	58.94	8.9	0.9095	37	7
28	Nickel	Ni	58.69	8.9	0.009133	4.6	17.5
29	Copper	Cu	63.54	8.94	0.08474	3.69	7.2
30	Zinc	Zn	65.38	7.14	0.06578	1.06	3.6
31	Gallium	Ga	69.72	5.91	0.05107	2.77	4
32	Germanium	Ge	72.60	5.36	0.04607	2.35	3
33	Arsenic	As	74.91	5.73	0.4607	4.1	6
34	Selenium	Se	78.96	4.8	0.3661	11.8	11
35	Bromine	Br	79.916	3.12	0.02351	6.6	8
36	Krypton	Kr	83.8	3.708×10^{-3}	0.2665×10^{-3}	28	7.2
37	Rubidium	Rb	85.48	1.53	0.01076	0.7	12
38	Strontium	Sr	87.63	2.54	0.1746	1.16	10
39	Yttrium	Y	88.92	3.8	0.02574	1.38	3
40	Zirconium	Zr	91.22	6.4	0.04226	0.18	8

Atomic Number	Element	Symbol	Atomic Weight	Density Gram/Cm³	Natoms/cm² × 10^{-24}	Absorption In barns	Scattering In barns
41	Niobium	Nb	92.91	8.4	0.5445	1.1	5
42	Molybdenum	Mo	95.95	10.2	0.06403	2.5	7
43	Technetium	Te	99	—	—	100	—
44	Ruthenium	Ru	101.7	12.2	0.7225	2.46	6
45	Rhodium	Rh	102.91	12.5	0.7316	150	5
46	Palladium	Pd	106.7	12.16	0.06864	8	3.6
47	Silver	Ag	107.88	10.5	0.05862	62	6
48	Cadmium	Cd	112.41	8.65	0.04635	2550 (1.30)	7
49	Indium	In	114.76	7.28	0.03721	190 (1.3)	2.2
50	Tin	Sn	118.7	7.28	0.03694	0.60	4
51	Antimony	Sb	121.76	6.691	0.03310	5.5	4.3
52	Tellurium	Te	127.61	6.24	0.02945	4.5	5
53	Iodine	I	126.91	4.93	0.02340	6.7	3.6
54	Xenon	Xe	131.3	5.85×10^{-3}	0.02684×10^{-3}	35	4.3
55	Caesium	Cs	132.91	1.873	0.008488	29	20
56	Barium	Ba	137.36	3.5	0.01535	1.17	8
57	Lanthanum	La	138.92	6.155	0.02669	8.9	15
58	Cerium	Ce	140.13	6.9	0.2966	0.7	9
59	Praseodymium	Pr	140.92	6.5	0.02778	11.2	—
60	Neodymium	Nd	144.27	6.95	0.2901	46	—
61	Promethium	Pm	14	—	—	—	—
62	Samarium	Sm	150.43	7.75	0.03103	5500 (1.5)	—
63	Europium	Eu	152	—	—	4600(0.95)	—
64	Gadolinium	Gd	156.9	—	—	46000(0.85)	—
65	Terbium	Tb	159.2	—	—	44	—
66	Dysprosium	Dy	162.46	—	—	1100	100
67	Holmium	Ho	164.94	—	—	64	—
68	Erbium	Er	167.2	4.77	0.01718	166	15
69	Thulium	Tm	169.4	—	—	118	—
70	Ytterbium	Yb	173.04	—	—	36	12
71	Lutetium	Lu	174.99	—	—	108	—
72	Hafnium	Hf	178.6	13.3	0.4486	105	8
73	Tantalum	Ta	180.88	16.6	0.5527	21.3	5
74	Tungsten	W	183.92	19.3	0.06320	21.3	5
75	Rhenium	Re	186.31	20.53	0.6637	84	14
76	Osmium	Os	190.2	22.48	0.07119	14.7	11
77	Iridium	Ir	193.1	22.42	0.06993	430	—
78	Platinum	Pt	195.23	21.37	0.6593	8.1	10
79	Gold	Au	197.2	19.32	0.5901	98	9.3
80	Mercury	Hg	200.61	13.546	0.04067	380 (0.95)	20
81	Thallium	Tl	204.39	11.85	0.03492	3.3	14
82	Lead	Pb	207.21	11.35	0.03298	0.17	11
83	Bismuth	Bi	209	0.747	0.02808	0.032	9
84	Polonium	Po	210	—	—	—	—
85	Astatine	At	210	—	—	—	—
86	Radon	Rn	222	9.73×10^{-3}	0.02640×10^{-3}	—	—
87	Francium	Fr	223	—	—	—	—
88	Radium	Ra	226.05	—	—	—	—
89	Actinium	Ac	227	—	—	—	—
90	Thorium	Th	232.12	11.3	0.02932	7	12.5

Atomic Number	Element	Symbol	Atomic Weight	Density Gram/Cm³	Natoms/cm² × 10^{-24}	Absorption In barns	Scattering In barns
91	Protactinium	Pa	221	—	—	—	—
92	Uranium	U	238.07	18.68	0.04726	7.68(0.99)	8.3
93	Neptunium	Np	—	—	—	—	—
94	Plutonium	Pu	—	—	—	—	—
95	Americium	Am	—	—	—	—	—
96	Curium	Cm	—	—	—	—	—
97	Berkelium	Bk	—	—	—	—	—
98	Californium	Cf	—	—	—	—	—
99	Einsteinium	Es	—	—	—	—	—
100	Fermium	Fm	—	—	—	—	—
101	Mendelevium	Md	—	—	—	—	—
102	Nobelium	No	—	—	—	—	—
103	Lawrencium	Lr	—	—	—	—	—
104	Rutherfordium	Unq	—	—	—	—	—
105							

- Barn is a unit of area equal to 10^{-24} Square centimetre, used in measuring cross section of atomic nuclei
- One barn equals 100 fm^2. The proper SI unit to use for these measurements is the square femto-metre (fm^2);
- Atomic number is the number of portions of the nucleus of an atom.
- The molecular weight of an element or a compound is the number of times one molecule of it is as heavy as one atom of hydrogen.
- Hydrogen has the same atomic number and atomic weight.
- An element cannot be split up into two or more simpler substances by any known process.
- The hardest metal known is Tungsten.
- Mercury is also known as 'Quick silver'.
- At normal temperature and pressure, every gas contains the volume of 22.4 litres.
- Every gas contains zero volume at 237° C of temperature.

Lightest & Heaviest Elements

The lightest substance known is Hydrogen and the heaviest is Osmium.

Smallest & Lightest Atom

Protium, the ordinary isotope of hydrogen having one proton in its nucleus and an electron revolving around it, is the smallest and lightest of all atoms. It does not have a neutron in its nucleus as a few other isotopes of hydrogen do. Thus, its mass is merely 1.008123 AMU (Atomic Mass Unit).

Physical Constants

Charge of electron (e)	= 1.602 × 10^{-19} coulombs
Mass of electrons (at rest) (m)	= 9.00 × 10^{-28} gramme
Ratio of electronic charge to mss (e/mo)	= 1.759 × 10^{18} coulomb per gramme
Radius of electron (at rest)	= 2.818 ×10^{-13} centimetres
Energy of 1 electron-volt	= 1.602 × 10^{-12} ergs
Velocity of light (c)	= 2.99776 × 10^{10} cm/sec= 186,000 miles/sec =2.99776 × 10^{4} m/sec
Planck's constant (h)	= 6.6 × 10^{-27} erg-second
Boltzmann constant (k)	= 1.38 × 10^{-16} erg per degree
Gas constant (R)	= 8.314 × 10^{7} ergs per gramme molecule
Avogadro's number	= 6.028 × 10^{27} per gramme molecule
Joule's constant (mechanical) (equivalent of heat)	= 4.18 Joules per calorie
Photoelectric constant (h_e)	= 4.135 × 10^{-7} erg-second per coulomb
Wavelength of electron of 'v' volts (in centimetre)	= 12.24 ×10^{-8}

International Frequency Band

Frequency	Cycles/sec	Designation		Wavelength
3,00,000	Megacycles	--	--	1 millimetre
30,000	Megacycles	EHF	Extremely high frequency	1 centimetre
3,000	Megacycles	SHF	Super high frequency	10 centimetres
300	Megacycles	UHF	Ultra high frequency	1 metre
30,000	Kilocycles	VHF	Very high frequency	10 metres
3,000	Kilocycles	HF	High frequency	100 metres
300	Kilocycles	MF	Medium frequency	1,000 metres
30	Kilocycles	LF	Low frequency	10 kilometres
3	Kilocycles	VLF	Very low frequency	100 kilometres
Microwaves have wavelengths of a few centimetres or less. They are used for satellite communication and Radar				